

LITERACY SKILLS, MATHEMATICAL SKILLS
AND EDUCATIONAL EXPECTATIONS AMONG
FINNISH ADOLESCENTS

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This study investigated the connection between educational expectations and skills in spelling, reading fluency and mathematics among Finnish 9th Graders. Connection between comorbidity of reading disability and mathematical disability with educational expectations was also examined. These connections were explored among boys and girls and the effects of parental education were assessed, as well. Cross tabulations and analyses of variance were used as tools for analyses.

Spelling, reading fluency and mathematics were connected to educational expectations, with higher skills leading to higher expectations. The largest difference between the educational expectation groups was in mathematics. Adolescents with reading disability (RD), mathematical disability (MD), or both set their educational expectations lower than peers with good skills.

Mathematics functioned as compensating factor against the effects of RD of educational expectations, but only in boys. As unresolved expectations were fairly common, the need of more information about educational and occupational options for adolescents was suggested. Attitudes of girls towards mathematics should also be targeted and encouraged.

Parental education was found to influence adolescents' secondary education choice. In addition, when parents had high education, the spelling skills of the adolescent contributed to their educational expectations, whereas in other parental education groups, spelling skills did not contribute to educational expectations. Highly educated parents may have more information considering different education options and that is why they could be more skillful in advising their children in educational choices. This contributes to the suggestion of more information for both adolescents and their parents. Further research about the effects of comorbidity on educational expectations is suggested.

Keywords: educational expectations, educational aspirations, reading skills, spelling skills, mathematical skills, comorbidity, familial risk, learning disabilities, reading disability, mathematical disability

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INTRODUCTION

Educational expectations and aspirations have been found to be one factor affecting the educational choices and attainment of adolescents in Finland and other countries (Schoon & Parsons, 2002; Savolainen, 2001, p. 164; Rothon, Arephin, Klineberg, Cattell, & Stansfeld, 2011). These expectations and aspirations have also found to be connected to school achievement (Marjoribanks, 2003; Mau, & Bikos, 2000; Savolainen, 2001, p. 164). However, often general achievement measures, which include many school skills, are explored and this leads to a dearth of research about how specific skills, as literacy skills and mathematical skills, affect educational expectations. Information about the effects of specific skills on educational expectations is needed to detect the critical skills influencing educational choices adolescents make. Students with specific learning disabilities (LD) are an extreme example of what impairment in a specific skill may cause, such as lower educational expectations (Rojewski, 1996a; Rojewski, 1999; Savolainen, 2001), and lower educational attainment (Ahvenainen, & Holopainen, 2005, p. 73; Linnakylä, Malin, Blomquist, & Sulkunen, 2000; Murray, Goldstein, Nourse, & Edgar, 2000).

Educational expectations among students with LD have been found to be different than among their peers without disabilities (Hiebert, Wong, & Hunter, 1982; Rojewski, 1999; Savolainen, 2001). The lower level of education and the preference for vocational options among individuals with LD have been found in Finland and other countries (Ahvenainen, & Holopainen, 2005, p.73; Murray et al., 2000). Different kinds of educational preferences are not negative per se but Rojewski (1996) and Elster (1983) have suggested the tendency of individuals with LD to lower their occupational expectations too broadly and limit educational options which would be possible for them to reach. It is important to explore which are the crucial skills connected to educational expectations as high education can, nevertheless, bring benefits, such as higher occupational status and income, for all adolescents (Suomen virallinen tilasto (SVT), 2011), and even for individuals with LD (Greenbaum, & Graham, 1996; Madaus, Foley, McGuire, & Ruban, 2001).

Reading fluency, spelling and mathematics are important skills; literacy skills forming a basis for all the learning (Linnakylä, et al., 2000) and mathematics as possible critical ability affecting educational choices (Astin, 1968; Shapka, Domene, & Keating, 2007). Furthermore, reading disabilities (RD) are often comorbid with problems in mathematics or mathematical disabilities (MD) (Dirks, Spyer, van Lieshout, & de Sonnevile, 2008), which may broaden problems in school achievement and educational attainment. Gender and parental education have also been shown to be important factors influencing educational expectations of Finnish adolescents (Savolainen, 2001).

In this study, I will explore the effects of literacy skills, spelling and reading fluency, and mathematical skills on educational expectations among Finnish adolescents. I will also explore the effect of having comorbid RD and MD on educational expectations and if the connection of specific skills and educational expectations is different among boys and girls or among different parental education groups in Finland.

Educational expectations and aspirations

In the literature educational expectations and aspirations are often not well defined (Rojewski, 2005, p.132). Johnson (1995) has emphasized the importance of a clear definition, as it would make the research more accurate and valid. Rojewski (2005) described educational aspirations as a part of occupational aspirations, which he defined as “expressed career-related goals or choices” (p. 132). Educational and occupational aspirations have also found to be related (Lent, & Brown, 1996; Mau, & Bikos, 2000; Rojewski, 2005, p. 137). According Rojewski (2005, p.132) aspirations are not always coherent and they may include different amount of commitment. Still, educational and occupational aspirations have found to be good predictors of both educational and occupational choices and attainment (Marjoribanks, 2003; Rojewski, 2005, p.132; Schoon & Parsons, 2002). Aspirations have been found to stabilize quite early, by the age of 14 (Furlong & Biggart, 1999; Rojewski, & Kim, 2003), and the coherence of aspirations improves their prediction validity (Rojewski, 2005, p.132).

Distinction between idealistic aspirations and realistic expectations has been seen as important (Rojewski, 2005, p.134). Occupational and educational aspirations are idealistic goals without any limiting factors, whereas occupational or educational expectations are realistic goals in which personal and contextual barriers are taken into account (Davey & Stoppard, 1993; McNulty & Borgen, 1988; Rojewski, 2005, p.134). In other words, expectations are seen as possible to reach while aspirations are sometimes considered unattainable dreams. Students often give higher aspirations than expectations and it has been suggested that occupational expectations may be better predictors of occupational choices and attainment than occupational aspirations, as they are seen realistic, possible options for future (Armstrong & Crombie, 2000; Heckhausen & Tomasik, 2002; Hellenga, Aber, & Rhodes, 2002). However, many studies have not made the distinction between aspirations and expectations, but the concepts have been used interchangeably.

Many theories of occupational choice have been represented. In several of them, educational expectations or aspirations have been seen as important mediums in reaching occupational positions. Some traditional psychological theories have emphasized individual factors and choice as the most important elements in occupational choice (Godfredson, 1981; Super, 1990), whereas traditional sociologically oriented theories see educational choice to be affected more by contextual factors (Blau, and Duncan, 1967, in Rojewski, 2005, p. 138). For Godfredson (1981) occupational aspirations primarily represent a way to find a place in social order, individuals eliminating options which do not support their occupational self-concept. By contrast, in sociological theories, such as Blau, and Duncan's (1967) status attainment theory, aspirations are seen as reflections of external barriers which regulate the occupational choice (in Rojewski, 2005, p.138).

In more current theories, both personal and environmental aspects are seen to be in interplay and together result in occupational choice. In Social Cognitive Career Theory (SCCT) of Lent, and Brown (1996), occupational choice is seen as a result of interaction between personal and contextual factors. Most important aspects in the theory are self-efficacy beliefs and socialization patterns and aspirations are seen as a reflection of these. In addition, self-efficacy beliefs and socialization patterns are in interaction with each other (Rojewski, 2005, p. 140). Eccles (1994) has also proposed a theory of educational and occupational choice. Her theory emphasizes the importance of subjective task value and individual's success expectations. In her theory, aspirations are seen as one reflection of subjective task value, which means how useful an individual sees the options for themselves to be in the future (Eccles, 1994). Subjective task value also explains gender variation in educational expectations, as boys and girls appreciate different kind of employment options and consider different subjects useful for their futures.

In my study I chose to use the concept of educational expectations to describe the realistic educational goals students have; in other words, what kind of education students plan to reach. Still, I also do an overview of research on educational aspirations, as it is concept broadly used, and yet strongly connected to educational expectations. There are sociodemographic factors which affect educational expectations and aspirations, and therefore I will next overview research about the connection of educational expectations with gender and parental education.

Educational expectations and gender

Gender has been proposed to be an important factor affecting formation of educational aspirations in theories (Eccles, 1994; Godfredson, 1981; Lent, & Brown, 1996), and on empirical studies (Fan, 2011; Rojewski, & Kim, 2003; Tynkkynen, et al., 2012). Recent studies show that girls set their educational expectations and aspirations higher than boys (Mau & Bikos, 2000; Mello, 2008; Savolainen, 2001, p. 98). However, there is a dearth of research about the connection of gender and educational expectations among students with poor skills. There is some evidence that girls with LD may have lower occupational expectations than girls and boys without LD or boys with LD (Rojewski, Lee, Gregg, & Gemici, 2012; Rojewski, 1996). Still, studies on the effect of gender and LD interaction, on educational expectations, have not been conducted. Elster (1983) and Rojewski (1996) suggested that girls with LD might be especially prone to broad elimination of educational options, and so to low educational and occupational expectations.

Educational expectations and parental education

Parental education has also been seen as very relevant factor affecting adolescents' educational choices in some theories (Blau, and Duncan, 1967 in Rojewski, 2005, p. 138). The connection between parental socioeconomic status and educational and occupational aspirations of adolescent have been found in Finland (Rimkute, Hirvonen, Tolvanen, Aunola, & Nurmi, 2011), and other countries (Marjoribanks, 2002; Rojewski, & Kim, 2003; Schoon and Parsons, 2002). In Finnish study parental education predicted adolescents' educational expectations on 7th and 9th Grade (Rimkute, et al., 2011). Parental education has also found to become even more important factor affecting adolescents' educational expectations as educational choice come closer (Rimkute, et al., 2011). The education of parents has been used as indicator of socioeconomic status in Finland (Ahola, & Nurmi, 1998; Rimkute, et al., 2011) as the state-provided and tuition-free educational system makes the education accessible for everyone and the attainment of education is not so dependent on wealth of the family. Savolainen (2001, p.97) showed in his study that, in Finland, parental education is even better predictor of adolescents' future education than parental occupational status. Moreover, in Finland, high parental education has been found to be connected

to high educational attainment for adolescents (Kivinen, Hedman, & Kaipainen, 2007, Myrskylä, 2011, p. 17; Savolainen, 2001, p. 107).

School achievement, learning disabilities (LD) and educational expectations

School achievement has been found to be positively correlated to educational expectations and educational aspirations in Finland and other countries (Marjoribanks, 2003; Savolainen, 2001, p. 164; Tynkkynen, et al., 2012). Specific, extreme examples of the effect of poor skills on educational expectations are different kind of educational expectations of adolescents with LD (Rojewski, 1996a; Rojewski, 1999; Savolainen, 2001). The educational expectations and aspirations of adolescents and young adults with LD are shown to be lower and there is more uncertainty about study plans among individuals with LD compared to nondisabled peers (Hiebert, et al., 1982; Rojewski, 1999; Savolainen, 2001). Also, in Finland, students with lower school success have been found to have more irrationality in educational expectations, and the more a student received special education the lower educational expectations they had (Savolainen, 2001, p. 98).

School achievement has been studied often with one broad measure including skills in all the school subjects and different skills have not been observed separately. However, it is important to know effects of different skills as this way we can find the crucial skills affecting future educational choices. Next, I will present research about the connection of literacy skills, mathematical skills, and comorbidity of RD and MD, with educational expectations and aspirations.

Literacy skills and educational expectations

The level of education and literacy skills are positively correlated in Finland (Linnakylä et al. 2000). This connection may be at least partly mediated by lower educational expectations among individuals with lower literacy skills. Still, the research about the connection between literacy skills and educational expectations is scarce. Here, I will first represent background information concerning literacy skills in Finland, special features of Finnish, and RD in Finland. After that, I

will describe the connection of educational expectations and literacy skills and lastly concentrate on the gender and parental education effects on literacy skills.

International Adult Literacy Survey found one third of Finnish adults to have deficits in literacy skills that may lead to difficulties in surviving in knowledge society of today (Linnakylä et al., 2000). 10-25 % of Finnish adolescents in vocational school and only two to three percent in high school have been reported to have problems in literacy skills (Ahvenainen, & Holopainen, 2005, p.73). Lyytinen, Leinonen, Nikula, Aro and Leiwo (1995) reported the estimated prevalence of RD to be six percent among the Finnish adult population. RD is the most prevalent disorder in the group of LD, comprising 80 % of LD cases (Lyon, Shaywitz, & Shaywitz, 2003). It is characterized by difficulties first in acquiring reading, writing and spelling skills and then achieving fluency and accuracy in these skills (Lyon et al., 2003). In the ICD-10 (World Health Organization, 2010) diagnoses concerning problems in literacy skills are called *specific reading disorder* (F81.0) and *specific spelling disorder* (F81.1). RD has neurological basis (Lyon, et al., 2003; Taipale, 2009, p. 35) and typical for RD are impairments in working memory (de Jong & van der Leij, 1999), phonological processing and rapid serial processing assessed with and Rapid Automatized Naming task (RAN) (Puolakanaho, et al., 2007; Vellutino, Fletcher, Snowling, & Scanlon, 2004; Wolf, Bowers, & Biddle, 2000). The relatives of individuals with RD have increased risk for having the same disability (Puolakanaho, et al., 2007; Torppa, Eklund, van Bergen, & Lyytinen, 2011), and the sample of this study includes individuals with familial risk for RD.

As Finnish is extremely transparent language, meaning that phonemes map clearly onto graphemes, it is fast language to learn to read for the most of the students (Holopainen, Ahonen, & Lyytinen, 2001). In orthographically transparent languages, such as Finnish, the main problems of reading are best seen in reading fluency, as reading accuracy becomes good very fast after learning to read (de Jong & van der Leij, 1999; Holopainen, et al., 2001; Zoccolotti, De Luca, Di Filippo, Judica, Martelli, 2009). Because of this, spelling and reading fluency were chosen for more accurate exploration in this study, whereas reading accuracy was left out from the analyses.

There are two Finnish studies showing links between literacy and educational expectations. Savolainen, Ahonen, Aro, & Holopainen (2008) showed reading fluency and spelling difficulties to influence educational expectations for secondary education choice, poor skills leading to lower educational expectations. Low educational aspirations have also showed to be linked to poor reading skills among Finnish adolescents (Linnakylä, Malin, & Taube, 2004, p. 165). However, the research about the connection between literacy skills and educational expectation is scarce in Finland and there is need for further research.

The links between literacy skills and educational expectations has been suggested to be different for boys and girls. Savolainen, et al. (2008) found in their study of Finnish adolescents, that problems in literacy skills affected more the secondary educational choice of boys than girls. The present study will add to the previous study by examining the effect of gender on the link between literacy skills and educational expectations. In addition, the present study will examine the effects of parental education on this link. The effects of parental education on the connection of educational expectations and literacy skills have not yet been studied in Finland.

Mathematics and educational expectations

Mathematical achievement has been suggested to be critical skill influencing the educational expectations and aspirations of adolescents (Astin, 1968; Shapka, et al., 2007). However, the research on the connection of these two is scarce. I will first present some background information about mathematical skills and MD in Finland. After that, I will represent research about the connection of educational expectations and mathematical skills and lastly I will review the effects of gender and parental education on this connection.

International studies exploring the mathematical skills, PISA 2003 and TIMSS 1999, indicate that, in general, Finnish adolescents are doing well in mathematics (Väljjarvi, et al., 2007, p. 11; Kupari, & Törnroos, 2004, p. 25). Nevertheless, Ahonen, and Haapasalo (2008, p. 493) found MD to impair the studying of as many as one fifth of secondary education students. Räsänen, and Ahonen (2002, p. 192) considered the prevalence of MD to be three to seven percent in Finnish population, which is close to international estimates for different countries (Gross-Tsur, Manor, & Shalev, 1996). In ICD-10 (World Health Organization, 2010) diagnosis for mathematical disability is called *specific disorder of arithmetical skills* (F81.2). It is characterized by “a specific impairment in arithmetical skills that is not solely explicable on the basis of general mental retardation or of inadequate schooling. The deficit concerns mastery of basic computational skills of addition, subtraction, multiplication, and division rather than of the more abstract mathematical skills”. MD is characterized by impairment in working memory (Adams, & Hitch, 1997; Gersten, Jordan, & Flojo, 2005), neurological basis (Taipale, 2009, p. 35) and familial risk (Monuteaux, Faraone, Herzig, Navsaria, Biederman, 2005; Shalev, et al., 2001).

Shapka, and colleagues (2007) found that students with poor mathematical skills tended to have lower educational expectations and also stronger decline in expectations after mid high school. Hammouri (2010) found also a connection between educational aspirations and mathematics skills for Jordanian adolescents, the higher educational expectation being associated to better mathematical skills. According to Sciarra (2010) mathematical skills were a good predictor for stability of educational expectations as well as good predictor for advanced math course completion. In addition, Ma (2001) found students' educational expectations to be connected to their advanced mathematics enrollment, and Fan and Karnilowicz (2011) indicated mathematics achievement to be related to the participants' self-defined achievement goals. It seems that there is an interaction between educational expectations and mathematical skills, and it can be partly mediating by more frequent advanced mathematical courses enrollment of students with better mathematical skills. Nonetheless, research is rare, specifically research on the connection of educational expectations and mathematical skills, and Finnish replication is lacking.

There is only one study that has investigated the connection of gender and mathematical skills on educational expectations. Shapka, and colleagues (2007) found in their study that gender did not influence the connection between mathematical skills and educational expectations. Studies in Finnish are completely lacking.

I will also examine influence of parental education on the connection of educational expectations and mathematical skills. Such studies have not yet been conducted in Finland.

Comorbidity and educational expectations

Comorbidity as a concept means that attributes of multiple disabilities are present in the same individual at the same time. In this study, I refer by comorbidity to co-occurrence of reading and mathematical disabilities. RD is often comorbid with problems in mathematics (Dirks, et al., 2008; Vukovic, Lesaux, & Siegel 2010; Simmons, & Singleton, 2008). It has even been suggested that the most of the RD cases have problems with mathematics (Ackerman, Anhalt, & Dykman, 1986). Lyytinen et al. (2000, p. 45), found in their sample including individuals with RD, that 14.3 % had combined condition with MD. Dirks, et al., 2008 found the prevalence of combined RD and MD to be 7.6 %, and Badian (1999) three percent of population. The prevalence estimates depend on the way of measurement and cut off criteria used, but despite the variation, it has been shown that when an individual has comorbid RD and MD, the condition is typically more severe than having just one

specific learning disability (Ackerman, & Dykman, 1995; Badian, 1999; Dirks et al., 2008; Shafrir, & Siegel, 1994). In comorbidity of RD and MD the cognitive profile is similar, though more severe, to specific RD (Badian, 1999; Fletcher, 2005; Shafrir, & Siegel, 1994). In contrast, specific MD shows quite different cognitive impairments (Badian, 1999; Fletcher, 2005; Shafrir, & Siegel, 1994). In comorbidity of RD and MD, phonological skills, short-term memory and visual reading, measured with correct recognition of visual form of the words, are impaired (Shafrir, & Siegel, 1994). The studies about the differences in connection of comorbidity and educational expectations among boys and girls have not been made to the knowledge of the author.

Research questions and hypotheses

Educational expectations have been found to be connected with school achievement among adolescents. Previous research has found educational expectations of individuals with LD to be lower and less clear than those of their peers. Even so, school achievement has often been explored as one single factor and different skills are not separated. This study contributes to the empirical literature on educational expectations firstly by differentiating between specific skills and exploring their influence on educational expectations. Secondly, the connection between comorbidity on educational expectations is assessed. Thirdly, also demographic factors of gender and parental education are explored as possible factors affecting these connections.

The research questions and the hypotheses of this study are:

1. Do educational expectations vary by gender? Are the level of parental education and their children's educational expectations connected?

Girls were expected to have higher educational expectations similarly to past research. According to previous studies it was expected that a high level of education among mothers and fathers would be connected to high level of educational expectations among their offspring.

2. Is there a connection between literacy skills (reading fluency, spelling) and educational expectations? Are literacy skills and educational expectations connected in the same way among boys and girls? Are literacy skills and educational expectations connected in the same way among different parental education groups?

Previous Finnish studies indicate both reading fluency and spelling to be correlated to educational expectations of secondary education choice, and therefore the hypothesis of this study is also that reading fluency and spelling are connected to educational expectations, lower skills leading to lower educational expectations. Research about the connection of literacy skills and educational expectations among boys and girls is scarce and mixed. The previous research suggests that girls have in general better literacy skills and higher educational expectations. Nevertheless, girls with LD have found to have lower educational expectations than boys with LD or peers without disabilities. It is hypothesized that the connection of literacy skills and educational expectations is different among boys and girls. Girls are expected to have lower expectations when they have poor literacy skills. Nevertheless, it is not possible to set more accurate hypothesis considering the connection of educational expectations and literacy skills between genders, due to scarcity of research. Furthermore, the lack of research makes it impossible to set hypothesis for effects of parental education on the connection of educational expectations and literacy skills.

3. Is there a connection between mathematical skills and educational expectations? Are mathematical skills and educational expectations connected in the same way among boys and girls? Are mathematical skills and educational expectations connected in the same way among different parental education groups?

Similar to past research, the hypothesis in this study is that mathematical skills and educational expectations are positively correlated. The only study concentrating on gender variation of the connection of educational expectations and mathematical skills (Shapka, et al., 2007), to the knowledge of the author, did not find any difference between genders, so in this study it is expected not to find any difference between the genders in the connection of educational expectations and mathematical skills. The shortage of research on effects of parental education on the connection of educational expectations and mathematical skills restrains from setting hypotheses.

4. Does comorbidity of RD and MD influence educational expectations of adolescents? Does comorbidity of RD and MD affect the educational expectations of boys and girls in the same way?

Studies about the connection between comorbidity and educational expectations have not been conducted in Finland or other countries. However, it has been shown that the comorbidity is more severe than having just one specific learning disability (Badian, 1999; Fletcher, 2005; Shafrir, &

Siegel, 1994), and suggested that especially girls with LD are at risk for low educational expectations (Elster, 1983; Rojewski, 1996a). The lack of research restrains from setting hypotheses.

METHOD

Participants

All adolescents, $n = 201$, in this study were participants of the Jyväskylä Longitudinal Study of Dyslexia (JLD) (e.g. Lyytinen et al., 2008). Originally participants were divided to two different groups: with or without familial risk for reading disability (i.e. parental dyslexia). Parents' reading disability status was confirmed through extensive individual assessments comprising reading, spelling, and phonological and orthographic processing. In addition, the parents of the family risk group reported a history of difficulties in learning to read and close family member(s) with reading and spelling problems (Leinonen, et al., 2001).

For this study children were further allocated to two groups according to their literacy skills at the end of the 2nd Grade (1) Children with reading disability (RD, $n = 54$), and (2) Control group of children, (C, $n = 128$). There were no differences between the groups in the parents' age or education, the children's performance IQ, age or gender distribution. All the children spoke Finnish as their native language and had no mental, physical, or sensory impairments. An exclusion criterion of the standard score below 80 in both Performance and Verbal IQ assessed at the 2nd Grade (Wechsler Intelligence Scale for Children; WISC-III-R; Wechsler, 1991) was applied to all participants. Four performance quotient subtests (Picture Completion, Block Design, Object Assembly, and Coding) and five verbal performance subtests (Similarities, Vocabulary, Comprehension, Series of numbers, and Arithmetic) were used to estimate the performance and verbal IQ measures, respectively. None of the participants were excluded according to the exclusion criterion. All participants attended regular classroom education.

Measures

Reading disability. The identification of children with reading disability was based on four tasks in Grade 8: 1. Oral word list reading, 2. Oral text reading, 3. Oral pseudoword text reading, and 4. Spelling pseudowords. A two-step procedure was used: First, a cut-off criterion for deficient performance was defined for each measure using the 10th percentile in the distribution of the children without family risk for reading disability. Second, a child was considered to have reading disability in Grade 8 if she / he 1) scored below the criteria in at least two out of three measures of reading speed or 2) in at least two out of three measures in reading / spelling accuracy.

Educational expectations, (9th Grade). Participants were given a questionnaire with a question: What is the highest level of education you are going to attain? Options for answer, given in the questionnaire were university, polytechnic, upper secondary school, vocational school, basic education, and unresolved expectations. The options of upper secondary school and basic education were excluded from the analyses as just few participants chose these options and as it is not likely that these participants finish education after basic education or upper secondary school as these educations do not enable good work opportunities nowadays in Finland.

Parental education. Parental education (reported at the entry stage of the project) was classified using a 7-point scale. This scale was constructed by combining the information that the parents had given concerning their general education (originally classified using a 3-point scale: e.g. 1 = previous system comprehensive school education including only primary education grades,..., 3 = comprehensive school education comprised of primary and lower secondary education grades 1 through 9 plus upper secondary general school) and their upper secondary vocational education and tertiary education (originally classified using a 5-point scale: e.g., 0 = no vocational education,..., 5 = higher university degree). These two scales were combined into one 7-point scale in the following way: 1 = comprehensive school education without any vocational education; 2 = comprehensive school education combined with short-term vocational courses; 3 = comprehensive school education combined with a vocational school degree; 4 = comprehensive school education combined with a vocational college degree; 5 = comprehensive school education combined with a lower university degree (Bachelor's) or a degree from a polytechnic; 6 = upper secondary general school diploma combined with a lower university degree (Bachelor's) or a degree from a

polytechnic; 7 = comprehensive school or upper secondary general school diploma combined with a higher university degree (Master's or a doctorate-level degree). The parents' education was attained by asking parents their educational level. The education of mother and the education of father were combined into the same variable. This variable was further allocated to three groups to make cross tabulation reasonable considering the size of the data. Low parental education group consisted of groups 1, 2 and 3 of earlier classification, middle education group consisted of groups 4 and 5 and the last, high education group, consisted of groups 6 and 7.

Oral word list reading, (8th Grade). In the standardized reading test of Lukilasse (Häyrinen, Serenius-Sirve, & Korkman, 1999) the participant had one minute to read aloud as many words, assembled vertically in columns, as possible from 105 item list. The length of the words increased gradually starting from 3 letters / word ending up 22 letters / word. The mean length of the words was 9.57 letters. A trained tester marked the incorrectly read words during the child's reading aloud. The correctness of tester markings was checked by another listener in 10% of the sample using the recordings, and the inter-rater reliability was .99.

Oral text reading (8th Grade). An age appropriate ordinary text for oral text reading (title "Fjelds of Lapland") consisted of 16 sentences in three paragraphs and a total of 207 words / 1591 letters (mean word length = 7.68 letters/word and mean sentence length = 12.94 words). Reading performance was recorded on a laptop computer. Total time to read the text was measured with a stop watch. The tapes and sound files were used to check the correctness of children's reading and the total time. In 10% of the sample each word was judged by two trained coders as correctly or incorrectly read, and the inter-rater agreement was .98.

Oral nonword text reading (8th Grade). The task was to read aloud a short text made up of 38 nonwords / 277 letters. The words and structure of the sentences resembled real Finnish in form but had no meaning. The mean word length was 7.29 letters / word. Similarly to the oral text reading, the child's reading performance was recorded and correctness of reading and time spent on reading were checked. In 10% of the sample each nonword was judged by two coders as correctly or incorrectly read, and the inter-rater agreement was .95.

Spelling pseudowords (8th Grade). The spelling accuracy was measured with a list of 20 pseudowords consisting of 3-5 syllabic items. Each pseudoword was counted as correct if all the

phonemes were correctly written and no missing or extra letters were included. The percentage of correctly written pseudowords was used as the measure for spelling accuracy. Cronbach's alpha reliability coefficient was .70.

Spelling nonwords (8th Grade). The task measuring nonword spelling was to write down nonwords with a computer program called Scriptlog. Participants heard nonwords through headphones and wrote them down on the computer. The computer program recorded all the answers. The task consisted of 12 2-syllabic items. Each nonword was counted as correct if all the phonemes were correctly written and no missing or extra letters were included. The sum of correct answers was used as a measure for spelling nonwords.

Spelling words (8th Grade). In the task measuring word spelling skills the participants heard words through headphones and they were asked to write them down. The test was a paper and a pencil task and consisted of 10 4-5 syllabic items. The sum of correct answers was used as the measure for word spelling. The Cronbach's alpha reliability coefficient was .55.

Spelling nonword sentences (8th Grade). The task was to write down 6 nonword sentences, heard through headphones. The sentences consisted of 3 words and the words and structure of the sentences resembled real Finnish in form but had no meaning. The task was a paper and pencil task. Both, the sum of correctly spelled sentences and the sum of correctly spelled words (18 items) were used as measures of spelling nonword sentences. The Cronbach's alpha reliability coefficient was .53.

Sum factors for literacy skills. Separate sum factors were formed for Spelling and Reading fluency. Sum factor for Reading fluency consisted of three earlier described tasks (Oral word list reading, Oral text reading, Oral nonword text reading). The Cronbach's alpha reliability coefficient of Reading fluency was .76. Sum factor for Spelling was formed of five spelling tasks described earlier (Spelling pseudowords, Spelling nonwords, Spelling words, Spelling nonword text). The Cronbach's alpha reliability coefficient of Spelling was .80.

KTLT-A (9th Grade). Mathematical skills were measured with standardized test for mathematical skills, KTLT-A (Räsänen, & Leino, 2005). The test includes 40 mathematical tasks of which 15 were basic arithmetic tasks (addition, subtraction, multiplication, division), 3 basic geometry tasks,

6 basic algebra tasks (equations, co-ordination tasks), 5 unit transformation, and 11 logical reasoning tasks. Many of the tasks were connected to every day-life. KTLT-A was conducted in group conditions among school classes and trained testers gave the instructions. KTLT-A is a paper and pencil task and time was limited to 40 minutes. The Crohnbach's alpha reliability coefficient was .91.

Description of data analysis

Answers for the first research questions of connection of gender and parental education with educational expectations were assessed using cross tabulations. The general picture of connection of parental education and educational expectations were attained through cross tabulation.

To explore the second research question about the effects of literacy skills on educational expectations univariate analyses of variance was used. After, two-way analyses of variance were conducted to explore if literacy skills and educational expectations are connected in the same way among boys and girls and among different levels of parental education.

Answer for the third research question, about the effects of mathematical skills on educational expectations, was also attained using univariate analyses of variance. After, two-way analyses of variance were conducted to explore if mathematical skills and educational expectations are connected in the same way among boys and girls and among different levels of parental education.

The last research question considered the effects of comorbidity to educational expectations. A cross tabulation was formed using 10 % cut off line for RD and MD. Last, the effect of comorbidity on educational expectations among boys and girls was explored by forming cross tabulations for both genders. Unfortunately, the size of the data did not allow more accurate exploration or exploration of the effects of parental education on the connection of comorbidity and educational expectations.

RESULTS

Preliminary analysis

First, variables forming sum factors of Reading fluency (Oral word list reading, Oral text reading, Oral nonword text reading) and Spelling (Spelling pseudowords, Spelling nonwords, Spelling words, Spelling nonword text) were standardized to z-scores making their average 0 and standard deviation 1. Variable measuring mathematical skills (KTLT-A) was also standardized to z-scores. To improve the normality of continuous factors, outliers were brought to tails of the distributions. Still, two extra outliers in the sum of Reading fluency were excluded from the analyses, as their values were more than three standard deviations from average (values: 4.46; 3.8). These cases had different educational expectations: vocational school and missing value. After, the sum factors for Reading fluency and Spelling were approximately normally distributed. The variable measuring mathematical skills was normally distributed. See Table 1. for descriptive statistic of continuous factors used in the analyses.

Table 1. Descriptive Statistic

Continuous factors	N	Minimum	Maximum	Mean	Std. Deviation
Reading fluency	180	-3.02	1.62	.05	.8
Spelling	182	-2.94	1.1	0	.77
Mathematics	160	-2.8	1.87	0	1
Education of parents	181	1	7	4.01	1.13

*(Reading Fluency consist of Oral word list reading, Oral text reading, Oral nonword text reading, Spelling consist of Spelling pseudowords, Spelling nonwords, Spelling words, Spelling nonword text, Mathematics consist of KTLT-A)

Before the analyses, the participants were first divided into different groups according to their educational expectations. The groups were divided according to answers to question: What is the highest level of education you are going to attain? The groups formed were called university group (n=40), polytechnic group (n=31), vocational school group (n=25) and unresolved expectation group (n=33). Then one-way analyses of variance were conducted to compare skills among the

groups. Educational expectation (1 = university, 2 = polytechnic, 3 = vocational school, 4 = unresolved) was used as between level variable in the analyses. See Table 2.

Table 2. Descriptive statistic for educational expectation groups

Educational expectations		N	Minimum	Maximum	Mean	Std. Deviation
University	Fluency	42	-.68	1.5	.36	.56
	Spelling	42	-1.08	.98	.35	.51
	Mathematic	42	-.88	1.87	.63	.75
Polytechnic	Fluency	33	-1.4	1.12	.09	.72
	Spelling	35	-2.49	1.1	-.14	.87
	Mathematic	34	-2.25	1.59	.06	.99
Vocational school	Fluency	26	-2.84	1.37	-.18	.84
	Spelling	26	-2.03	.88	-.18	.79
	Mathematic	27	-2.25	1.18	-.6	.88
Unresolved	Fluency	35	-2.03	1.23	.01	.82
	Spelling	35	-.98	1.1	.22	.45
	Mathematic	35	-1.70	1.73	-.07	.85

As the sample of this study included individuals with family risk for reading disability, also the effects of family risk were assessed. First, a cross tabulation was formed and adjusted standardized residuals were interpreted significant when $x < -2$ or $x > 2$. Familial risk for dyslexia was significant only among the vocational school group in cross tabulation. There were more individuals with risk status in the vocational school group than expected according to adjusted standardized residuals in cross tabulation (2.2). But the result was not significant ($X^2(3) = 6.02, p = .11$). For more accurate analysis, variance analyses were conducted with 2 between level variables, family risk (1 = risk, 2 = no risk) and educational expectation (1 = university, 2 = polytechnic, 3 = vocational school, 4 = unresolved). The analyses were conducted for all the skills separately (reading fluency, spelling, mathematics) but all the interactions were nonsignificant. Thus, analyses about family risk are not, further reported.

Gender, parental education and educational expectations

The first research question considered the connection between gender and educational expectations. A cross tabulation was formed to observe this connection. Standardized adjusted residuals were used to indicate a significant difference. In cross tabulation gender was connected to expectations so that university expectations were more popular among girls than boys (2.6) and polytechnic was preferred more among boys than girls (2.3) ($X^2(3) = 9.00, p = .03$).

To answer the research question about the connection of the education of parents and educational expectations of adolescents, a cross tabulation was formed. According to the cross tabulation, the low parental education group reported more than expected vocational school expectations (3.8) as stated by adjusted standardized residuals, ($X^2(6) = 18.65, p = .005$). The vocational school expectations were underrepresented in the high parental education group (-2.9).

Literacy skills and educational expectations

One-way analysis of variance showed that there was a significant difference between educational expectation groups in reading fluency ($F(3, 136) = 3.36, p = .021$). Post hoc analysis using the Bonferroni post hoc criterion for significance indicated that significant difference existed only between university group ($M = -.36, SD = .56$) and vocational school group ($M = .18, SD = .84$), university group having higher reading fluency skills.

A significant difference in spelling was also detected between educational expectation groups with one-way ANOVA ($F(3, 138) = 5.46, p = .001$). Post hoc analysis using the Bonferroni post hoc criterion for significance indicated differences between university ($M = .35, SD = .51$) and vocational school ($M = -.18, SD = .79$) groups and university and polytechnic ($M = -.14, SD = .87$) groups. University group had higher spelling skills in both comparisons.

Gender, educational expectations and literacy skills

To investigate the connection between gender, educational expectations and literacy skills, analyses of variance were conducted with 2 between level variables, gender (1 = boy, 2 = girl) and educational expectation (1 = university, 2 = polytechnic, 3 = vocational school, 4 = unresolved). The analyses were made separately for reading fluency and spelling.

Gender ($F(1, 136) = .01, p = .946$) did not have a significant main effect on reading fluency skills. In contrast, educational expectations had a significant main effect on reading fluency ($F(3, 136) = 3.36, p = .021$). A significant interaction of educational expectations and gender was not found ($F(3, 136) = .214, p = .1$). See Figure 1.

Gender had a significant main effect on spelling skills ($F(1, 136) = 4.46, p = .04$). In spelling girls had higher skills. The educational expectations had also a significant main effect on spelling skills ($F(3, 136) = 3.59, p = .02$). The interaction of gender and educational expectations was found as well ($F(3, 136) = 2.87, p = .04$). The interaction shows that even though boys had poor skills in spelling they still set their educational expectations high (polytechnic) whereas only girls with good spelling skills had university or polytechnic expectations. There was also a big difference in spelling skills between the boys who set university expectations and boys who set polytechnic expectations, so spelling skills separated university expectations from lower expectations for boys. See Figures 1 and 2.

Figure 1. The literacy skills in educational expectations groups by gender

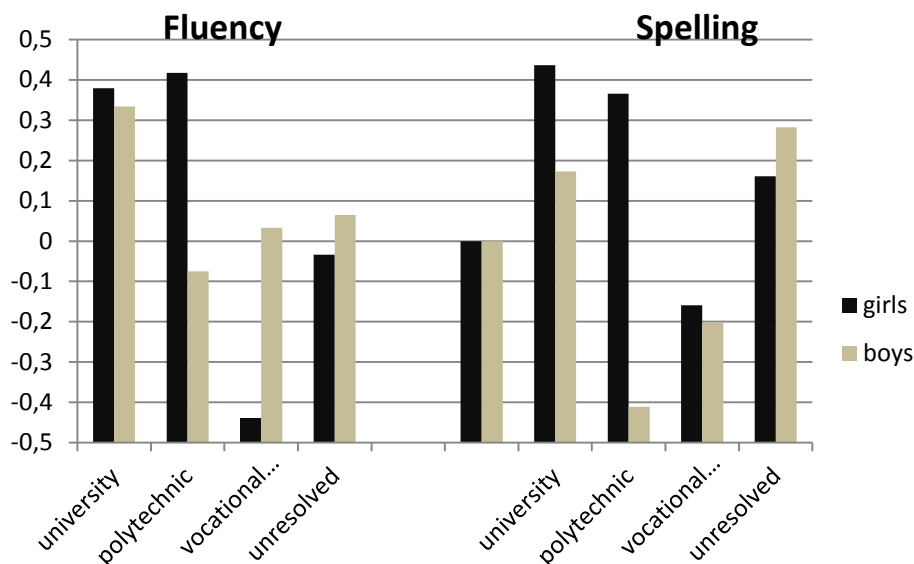
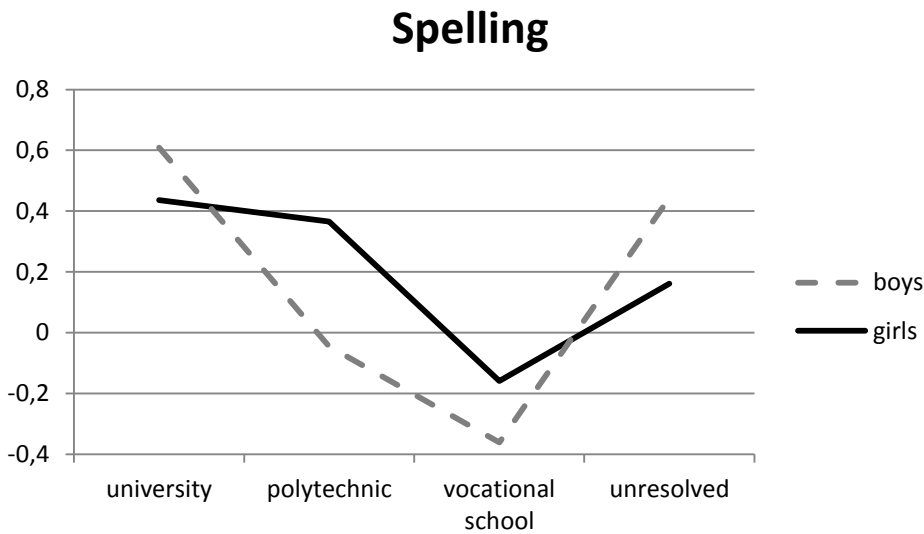


Figure 2. Interaction of gender and educational expectations in spelling skills



Parental education, educational expectations and literacy skills

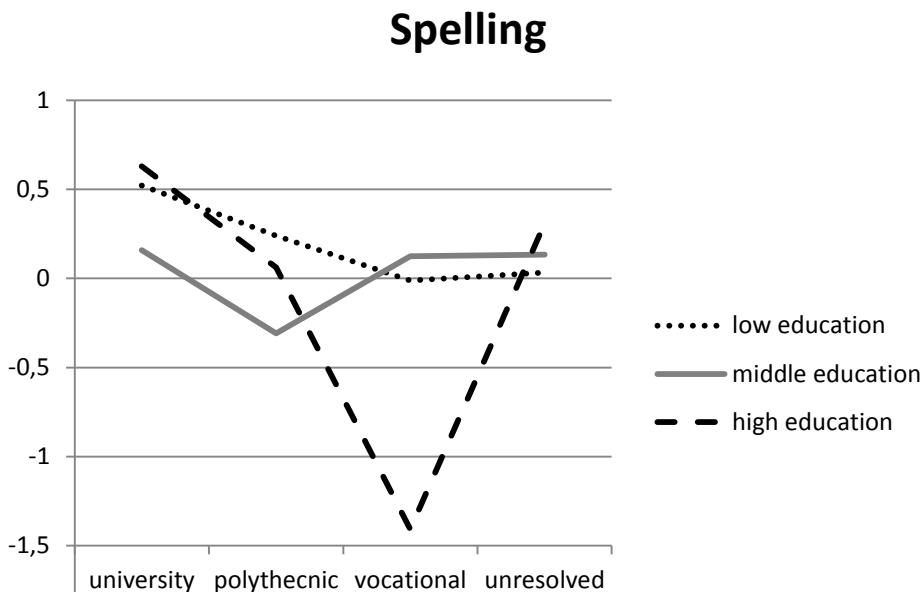
Parental education, educational expectations and literacy skills were explored with a two-way analysis of variance. Education of parents was used as a continuous factor. Analyses of variance were conducted with two between level variables, education of parents (1 = low, 2 = middle, 3 = high) and educational expectation (1 = university, 2 = polytechnic, 3 = vocational school, 4 = unresolved).

The analysis did not indicate significant main effect for educational expectations ($F(3, 124) = 2.52, p = .06$), nor parental education ($F(2, 124) = 1.96, p = .15$) in reading fluency skills. Neither interaction of educational expectations and parental education was found in fluency skills ($F(6, 124) = 0.66, p = .68$).

The analysis did not indicate a significant main effect for parental education in spelling skills ($F(2, 124) = 1.49, p = .23$). The significant main effect was found for educational expectations in spelling skills ($F(3, 124) = 6.74, p = .00$). There was also a significant interaction of parental education and educational expectations in spelling skills ($F(6, 124) = 2.9, p = .01$). The interaction showed that in the group of high parental education, low spelling skills and low expectations were

connected whereas in other parental education groups the spelling skills were not linked to the educational expectation of adolescents. See Figure 3.

Figure 3. The interaction of parental education and educational expectations in spelling skills



Mathematics and educational expectations

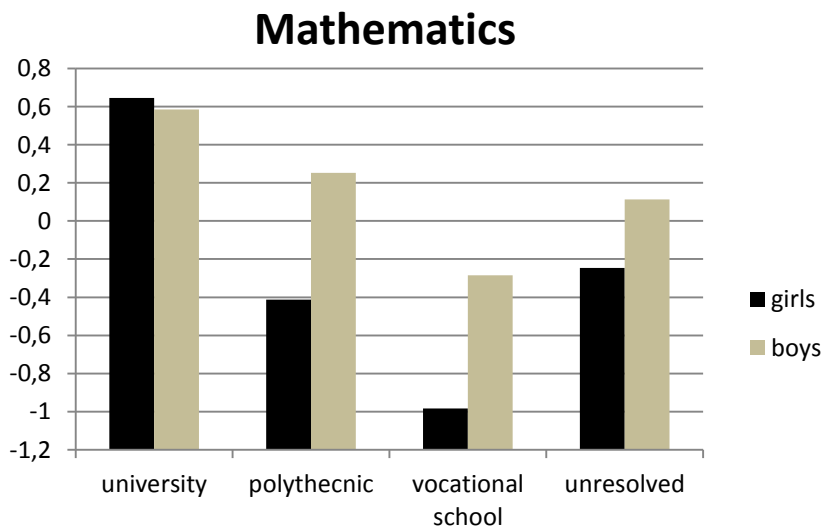
There was also a significant difference between educational expectation groups in mathematical skills ($F(3, 138) = 11.43, p = .00$). Post hoc analysis using the Bonferroni post hoc criterion for significance showed differences between university group and all the other groups. University group had better mathematical skills than any other group. Unresolved group differed significantly only from university group. Also polytechnic and vocational school groups differed significantly from each other and in this comparison polytechnic group outperformed vocational school group in mathematical skills. See Table 2. for means and standard deviations of the groups.

Gender, educational expectations and mathematics

To investigate the connection between gender, educational expectations and mathematics, analyses of variance were conducted with 2 between level variables, gender (1 = boy, 2 = girl) and educational expectation (1 = university, 2 = polytechnic, 3 = vocational school, 4 = unresolved).

Gender had a significant main effect on mathematical skills ($F(1, 138) = 7.65, p = .00$), boys performing better. Educational expectations had also a significant main effect on mathematical skills ($F(3, 138) = 12.03, p = .00$). The significant interaction of gender and educational expectations on mathematical skills was not found ($F(3, 138) = 1.47, p = .23$). See Figure 4.

Figure 4. Mathematical skills in educational expectation groups by gender



Parental education, educational expectations and mathematics

The connection of parental education, educational expectations and mathematical skills were explored with a two-way analysis of variance. Education of parents was used as a continuous factor. Analyses of variance were conducted with two between level variables, education of parents (1 =

lowest, 2 = middle, 3 = highest) and educational expectation (1 = university, 2 = polytechnic, 3 = vocational school, 4 = unresolved).

Main effect for parental education was not found in mathematical skills ($F(2, 127) = .68, p = .51$). In contrast, educational expectations showed a main effect on mathematical skills ($F(3, 127) = 5.83, p = .00$). The interaction of parental education and educational expectations was not significant ($F(6, 127) = .16, p = .99$).

Comorbidity and educational expectations

To explore specific effects of RD, MD and their comorbidity the students were divided into four groups. In formulation of these groups the lowest 10th percentile of literacy skills and mathematical skills was considered having RD or MD. The groups formed were Good skills = Good mathematics and literacy, RD = Good mathematics and poor literacy skills (reading disability), MD = Poor mathematics and good literacy skills (mathematical disability) and RD + MD = Poor skills in mathematics and literacy. A more accurate description of criteria for Reading disability can be found in the Method- section.

A cross tabulation was formed and the differences were significant ($X^2(9) = 22.17, p = .008$). Standardized adjusted residuals were used to indicate a significant difference. Good skills group had university expectations more often than expected (3.4) and vocational school expectations less often than expected (-2.6). When students had RD, they did not plan to study in university as often as expected (-2.3). Students with MD had vocational expectations more often than expected (2.4). Also combined RD and MD increased the preference for vocational schooling more often than expected (2.4).

Table 3. Cross-tabulation of comorbidity and educational expectations

Educational expectations			University	Polytechnic	Vocational school	Unresolved	Total
Total	Good skills	Count	36	22	12	21	91
		Adjusted Residual	3.4	-4	-2.6	-.8	
	RD	Count	4	10	7	9	30
		Adjusted Residual	-2.3	1.2	.7	.7	
	MD	Count	0	0	3	2	5
		Adjusted Residual	-1.5	-1.3	2.4	0.8	
	RD + MD	Count	0	1	3	1	5
		Adjusted Residual	-1.5	-.3	2.4	-.3	
Total		Count	40	33	25	33	131

Gender, educational expectations and comorbidity

The cross tabulation was formed to examine the differences in educational expectations among girls and boys with good skills, RD, MD or RD and MD. For girls the differences between the groups in educational expectations were significant ($X^2(9) = 25.67, p = .002$). The girls with good skills set university expectations more often (3.2) and vocational expectations less often (-3.3) than expected. Girls with MD aimed for vocational school more often than expected (3.2). For boys the cross tabulation was not significant ($X^2(9) = 9.43, p = .40$). It is still worth a note that in the RD group it was popular to reach for polytechnic education so it seems that good mathematics may enable high educational expectations for boys in spite of reading disability. See Table 4.

Table 4. Comorbidity and educational expectations by gender

Educational expectations

Gender			University	Polytechnic	Vocational school	Unresolved	Total	
Girl	Good skills	Count	25	9	4	11	49	
		Adjusted Residual	3.2	1.2	-3.3	-1.7		
	RD	Count	1	0	2	5	8	
		Adjusted Residual	-1.7	-1.3	.7	2.3		
	MD	Count	0	0	3	1	4	
		Adjusted Residual	-1.7	-.9	3.2	-.1		
	RD + MD	Count	0	1	2	1	4	
		Adjusted Residual	-1.7	.6	1.8	-.1		
	Total		Count	26	10	11	18	65
	Boy	Good skills	Count	11	13	8	10	42
			Adjusted Residual	1.3	-.9	-.6	.3	
		RD	Count	3	10	5	4	22
Adjusted Residual			-1.1	1.3	.2	-.6		
MD		Count	0	0	0	1	1	
		Adjusted Residual	-.5	-.7	-.5	1.9		
RD + MD		Count	0	0	1	0	1	
		Adjusted Residual	-.5	-.7	1.9	-.5		
Total		Count	14	23	14	15	66	

Unfortunately it was not possible to explore the comorbidity among parental education groups as the size of the data is limited.

DISCUSSION

This study investigated the relationship of literacy skills and mathematical skills to educational expectations. The effects of gender and parental education on these relations were also examined. Here I will summarize empirical findings, discuss the implications and limitations and suggest future research.

Spelling, reading fluency and mathematics were important skills in forming educational expectations. Mathematics was the best skill in separating the educational expectation groups and especially important skill in forming educational expectations. To have good skills in literacy and mathematics, was a prerequisite for aiming for university, whereas adolescents with LD set their educational expectations lower than peers.

Connection of educational expectations with gender and parental education

Gender was shown to be connected to educational expectations, university expectations being more popular among girls and polytechnic expectations preferred more among boys. This is in line with our hypothesis and previous research (Mau & Bikos, 2000; Mello, 2008; Rothon, et al., 2011; Savolainen, 2001, p. 98). Nevertheless, this difference in educational expectations may reflect the differential occupational preferences among boys and girls, as many technical employments, preferred by boys, are achievable through polytechnic education.

The effects of parental education were shown as vocational school expectations were popular among the low parental education group, and underrepresented among the high parental education groups. Our hypothesis received some support, even though it can be seen as surprising that parental education affected just the attitude towards vocational school. However, as secondary choice is immediate for 9th Graders, whereas polytechnic and university education are still more distant, the effect of parental education may be more visible in secondary education choices. This is consistent with the finding of Rimkute, Hirvonen, Tolvanen, Aunola, and Nurmi, (2011) as in their study educational expectations predicted secondary education choice. However, if the finding implies that all the parental education groups consider university as an option, it is very positive result and could possibly result from Finnish education system, which decreases the effects of economic factors in accessing higher education. As education still passes from one generation to the

next in Finland, (Myrskylä, 2009), this still seems like too optimistic a view, and the actuality of the educational decisions as more realistic explanation.

Literacy skills and educational expectations

It was hypothesized that there is a connection between literacy skills (reading fluency, spelling) and educational expectations according to previous research (Linnakylä, et al., 2004, p. 16; Savolainen et al., 2008). These hypotheses got support as both reading fluency and spelling were connected to educational expectations. However, spelling was more accurate in differentiating educational expectation groups from each other. This is noteworthy because, in transparent languages, spelling has been considered as an easy skill to learn due to strong connection between graphemes and phonemes (de Jong & van der Leij, 1999; Holopainen, et al., 2001; Zoccolotti, et al., 2009). Yet according to this study spelling seems to have stronger influence on formation of educational expectations than reading fluency.

The connection between spelling skills and educational expectations was different among boys and girls. Many boys set their educational expectations high (polytechnic) despite poor skills in spelling. In contrast only girls with good spelling skills set university or polytechnic expectations. One possible explanation for this may be the better mathematical skills of boys, as mathematics may function as a compensating factor against poor literacy skills for boys. This may also highlight the different kind of preferences in employment choices, as boys often prefer technical fields where mathematical skills are appreciated and reading not as important. Nonetheless, for boys spelling skills also separated university expectations from lower expectations. Only boys with good spelling skills aimed for university. This can however, be considered reasonable as studies in university include a lot of reading and writing.

For girls spelling separated university and polytechnic expectations from lower vocational school expectations. This means that girls with poor spelling skills aimed for vocational school education and this may support the claim, that girls set their expectations too low; that they are not brave enough to set high expectations if they lack skills (Elster, 1983; Rojewski, 1996a). Spelling seemed to be an important skill for girls in forming their educational expectations as it determined if girls aimed for high or low education.

In the group of high parental education, low spelling skills and low educational expectations were connected, whereas in other parental education groups, spelling skill did not seem to play a role in the educational expectation of adolescents. This is interesting, as it seems that when parents have high education, the spelling skills of the adolescent contribute to their educational expectations, whereas when parents have middle or low level education spelling skills do not matter. One explanation is that highly educated parents have more information considering different education options, and because of this they are more skillful in advising their children in educational choices. This may mean that the children of highly educated parents set more realistic expectations. It is interesting that this effect is visible only in spelling skills.

Mathematical skills and educational expectations

Mathematical skills were connected to educational expectations, so the hypothesis of this study was supported. The finding is also in line with previous research (Hammouri, 2010; Shapka, et al., 2007). The university expectation group differed most from the other groups, and, in contrast, unresolved expectation group differed just from university group. Mathematical skills differentiated educational expectation groups more from each other than literacy skills, so mathematical skills seem to be particularly important skill in forming educational expectation.

As a group, the unresolved expectation group differed from other groups the least. It differed only from the university expectation group in mathematical skills. It seems that the unresolved expectation group was doing quite well in both literacy and mathematical skills. The group may include students who plan to continue to high school and still ponder of their educational choices. In Finland, it is common to postpone the educational decisions just after upper secondary school, as these consist of general knowledge studies and keep all employment options open. The finding of the earlier research that there is more uncertainty in educational expectations among adolescents with LD (Rojewski, 1999; Savolainen, 2001) did not receive support in this study. However, unresolved expectations were common in general, and as most adolescents of the unresolved expectations group had good skills, this reflects the nature of Finnish school system, in which many adolescents make educational decisions just after upper secondary school. Still, as unresolved expectations were common so close to secondary education choice, it is important offer more knowledge about the different educational and occupational options for adolescents. Other studies

have also suggested the need for earlier information about the educational and occupational options for adolescents (Trusty, 2000).

In accordance with the only study exploring gender variation between the connection of educational expectations and mathematical skills (Shapka, et al., 2007), this study did not find a difference between boys and girls in the connection of educational expectations and mathematical skills. Boys had better mathematical skills, but still the connection between mathematical skills and educational expectations was similar among boys and girls, with strong mathematical skills leading to high educational expectations. Still, in the figure presented, a trend was shown that girls seemed to have university expectations only with high mathematical skills, whereas among boys, skills were moderately decreasing with educational expectations. With larger data the result could reach significance. Parental education did not influence the connection of educational expectations and mathematical skills.

Comorbidity and educational expectations

Good skills in both math and reading, often led to university expectations. This is in accordance with previous research indicating good school achievement to lead to high educational expectations (Rimkute, et al., 2011; Schoon, & Parsons, 2002; Tynkkynen, Tolvanen, & Salmela-Aro, 2012). When students had RD or MD, or comorbidity, they did not expect for university education.

MD and comorbidity resulted in increased preference for vocational school education, and RD resulted more rarely in preference for university expectation than expected. The results are consistent with past research, as it has been indicated that adolescents with LD have lower educational expectations (Hiebert, et al., 1982; Rojewski, 1999; Savolainen, 2001) and preference for vocational options (Ahvenainen, & Holopainen, 2005, p.73; Murray et al., 2000). Even so, as indicated by Rojewski (1996) lowered aspirations of individuals with LD may reflect an accurate and realistic assessment of personal abilities and skills.

The interesting finding was that many boys with RD aimed for polytechnic, whereas the boys and girls with MD or comorbid RD and MD had vocational school or unresolved expectations. The same was not evident for girls with RD as they did not reach for polytechnic, but had vocational school or unresolved expectations. This may reflect first the compensating effect of mathematics for boys, secondly the different kind of employment preferences and thirdly different values given to

school subjects by boys and girls, supporting the theory of Eccles (1994). For boys, mathematics seems to be more crucial skill in forming educational expectations than literacy skills, as many of the boys reached for polytechnic despite RD, while MD or comorbidity led to vocational school or unresolved expectation.

The suggestion that girls with LD are at risk for low educational expectations, received some support, as girls with MD aimed for vocational school more often than expected, girls with RD expected to continue mostly to vocational school or had unresolved expectations and girls with RD + MD had the same tendency as the RD girls. Thus for girls, any kind of LD leads to low or unresolved expectations and unfortunately other skills did not seem to compensate the effects of poor literacy or mathematical skills. In general, university expectation was the most common educational expectation for girls, whereas the educational expectations of boys were more evenly distributed. In consequence, girls with poor skills have to compare themselves with more ambitious peers. This may lead girls with poor skills to decrease their educational expectations to vocational school, as they do not see themselves to have a chance of attaining university degree. This is in line with previous suggestions of Elster (1983) and Rojewski (1996). These common high expectations among girls may also contribute to the fact that girls are at risk for internal problem behavior, such as anxiety and depression (Salmela-Aro, 2010). In the future, further research about the connection between comorbidity and educational expectations is needed, and also the possible effects of parental education on this connection should be explored.

Limitations and implications

One limitations of the study is the amount of missing data. Because the data had more missing cases in the poorest scale of the skill distributions, the findings may be biased in that the low educational expectations are underrepresented in the sample. In addition, the size of the data was quite small. As the sample included adolescents with familial risk for RD, individuals with RD were better represented in the sample than individuals having MD. This is in line with previous prevalence estimates showing that RD is more common than MD, but the amount of individuals with MD or comorbidity was very low in the sample. As missing cases often had poor skills, this may contribute to the low amount of data in these groups. Because of this one should be cautious in generalizing the results considering the group sizes. It must be remembered that the data allows the results to be

generalized only to Finnish adolescents, as the special nature and high transparency of Finnish orthography and the nature of Finnish educational system restricts generalizing. The replication in other transparent languages would be interesting, as well as research on the connection of skills with occupational expectations.

The literacy skills were measured on 8th Grade and educational expectations on 9th Grade so skills preceded measurement of educational expectations. This study was cross-sectional but the use of the longitudinal design would allow examination of the interactional development of skills and educational expectations.

Mathematics functioned as compensating skill against poor literacy skills just for boys. Consequently, the attitudes of girls towards mathematics should be targeted and encouraged. Particularly girls with poor skills seem to be at risk for low educational expectations, although also boys with MD and comorbidity seem often have low or unresolved educational expectations. As unresolved expectation were fairly common, more information about educational and occupational options, and the connections between these two, should be offered for adolescents, as well as examples breaking traditional gender norms in occupational choices.

Parental education still strongly passes from one generation to the next one, and it seems that educational expectations may be one mediator in this process. Still, parental education influenced just the attitude towards vocational school in this study. In addition, when parents have high education, the spelling skills of the adolescent contribute to their educational expectations, whereas when parents have middle or low level education spelling skills do not matter. One explanation is that highly educated parents have more information about education options and consequently they are better advisers for their children in educational choices. This contributes to the suggestion of more information for adolescents and also for their parents.

REFERENCES:

- Adams, J., & Hitch, G., (1997). Working memory and children's mental addition. *Journal of experimental child psychology* 67, 21–38.
- Ackerman, P., Anhalt, J., & Dykman, R., (1986). Arithmetic automatization failure in children with attention and reading disorders: Associations and sequela. *Journal of Learning Disabilities*, 19, 222-232. dx.doi.org.ezproxy.jyu.fi/10.1177/002221948601900409
- Ackerman, P., & Dykman, R., (1995). Reading-disabled students with and without comorbid arithmetic disability. *Developmental Neuropsychology*, 11, 351-371. dx.doi.org.ezproxy.jyu.fi/10.1080/87565649509540625
- Ahola, S., & Nurmi, J., (1998). Koulutusväylät, työmarkkinat ja valikoituminen: loppuraportti (Opetusministeriö). Helsinki : Vammalan kirjapaino.
- Ahonen, T. & Haapasalo, S., (2008). Oppimisvaikeudet.
In P. Rissanen, T. Kallanranta, & A. Suikkanen, (Eds.), *Kuntoutus*, (pp. 489- 506). Helsinki: Duodecim.
- Ahvenainen. O. & Holopainen. E. (2005). Lukemis- ja kirjoittamisvaikeudet: teoreettista taustaa ja opetuksen perusteita. 2. painos. Jyväskylä: Kirjapaino Oma
- Armstrong, P., & Crombie, G., (2000). Compromises in adolescents' occupational aspirations and expectations from grades 8 to 10. *Journal of Vocational Behavior*, 56, 82–98. doi:10.1006/jvbe.1999.1709
- Astin, H., (1968). Career development of girls during the high school years. *Journal of Counselling Psychology*, 18, 838-540.
- Badian, N., (1999). Persistent arithmetic, reading, or arithmetic and reading disability. *Annals of Dyslexia*, 49, 45-70.
- Blau, P., & Duncan, O., (1967). *The American Occupational Structure*. New York: John Wiley & Sons.

In Rojewski, J., (2005). Occupational aspirations: constructs, meanings and application. In S. Brown, & R. Brown (Eds.), *Career Development and Counseling: Putting Theory and Research to Work* (pp. 131-154). Hoboken, New Jersey: Wiley.

Davey, F., & Stoppard, J., (1993). Some factors affecting the occupational expectations of female adolescents. *Journal of Vocational Behavior* 43. 235-250.

Dirks, E., Spyer, G., van Lieshout, E., & de Sonnevile, L., (2008). Prevalence of combined reading and arithmetic disabilities. *Journal of Learning Disabilities*, 41, 460- 473. DOI: 10.1177/0022219408321128

Eccles, J., (1994). Understanding women's educational and occupational choices. *Psychology of Women Quarterly*, 18, 585- 609.

Elster, J., (1983). *Sour Grapes: Studies in the Subversion of Rationality*. Cambridge: Cambridge University Press.

Fan, W., (2011) Social influences, school motivation and gender differences: an application of the expectancy-value theory. *Educational Psychology: An International Journal of Experimental Educational Psychology*, 31, 157-175. DOI: 10.1080/01443410.2010.536525

Fan, C., & Karnilowicz, W., (2011). The mathematics achievement and aspirations of Chinese-Australian girls and Anglo-Australian girls in Australia. *Current Research in Social Psychology*, 5, 170-190.

Fletcher, J., (2005). Predicting math outcomes : Reading predictors and comorbidity. *Journal of Learning Disabilities*, 38, 308- 312. DOI: 10.1177/00222194050380040501

Furlong, A., & Biggart, A., (1999). Framing 'Choices': a longitudinal study of occupational aspirations among 13- to 16-year-olds. *Journal of Education and Work*, 12, 21-35.

Gersten, R., Jordan, N., & Flojo, J., (2005). Early identification and interventions for students with mathematics difficulties. *Journal of Learning Disabilities*, 38, 293- 304.

Godfredson, L.. (1981). Circumscription and compromise: A developmental theory of occupational aspirations. *Journal of Counseling Psychology Monograph*. 28. 545-579.

- Greenbaum, B., Graham, S., & Scales, W. (1996). Adults with learning disabilities: Occupational and social status after college. *Journal of Learning Disabilities*, 29, 167-173. DOI: 10.1177/002221949602900206
- Gross-Tsur, V., Manor, O., & Shalev, R., (1996). Developmental dyscalculia: Prevalence and demographic features. *Neurology*, 38, 25-33. dx.doi.org.ezproxy.jyu.fi/10.1111/j.1469-8749.1996.tb15029.x
- Hammouri, H., (2004). Attitudinal and motivational variables related to mathematics achievement in Jordan: findings from the Third International Mathematics and Science Study (TIMSS). *Educational Research*, 46, 241-257. dx.doi.org/10.1080/0013188042000277313
- Heckhausen, J., & Tomasik, M., (2002). Get an apprenticeship before school is out: How German adolescents adjust vocational aspirations when getting close to a developmental deadline. *Journal of Vocational Behavior* 60, 199–219. doi:10.1006/jvbe.2001.1864
- Hellenga, K., Aber, M., & Rhodes, J., (2002). African American adolescent mothers' vocational aspiration-expectation gap: Individual, social and environmental influences. *Psychology of Women Quarterly*, 26, 200–212. DOI: 10.1111/1471-6402.00059
- Hiebert, B., Wong, B., & Hunter, M., (1982). Affective influences on learning disabled adolescents. *Learning Disability Quarterly*, 5, 334- 343.
- Holopainen, L., Ahonen, T., & Lyytinen, H., (2001). Predicting delay in reading achievement in a highly transparent language. *Journal of Learning Disabilities*, 34, 401-413. doi: 10.1177/002221940103400502
- Häyriinen, T., Serenius-Sirve, S., & Korkman, M., (1999). *Lukilasse [The Lukilasse Graded Achievement Package for Comprehensive School Age Children]*. Helsinki: Psykologien Kustannus.
- Johnson, L., (1995). A multidimensional analysis of the vocational aspirations of college students. *Measurement & Evaluation in Counseling & Development*. 28. 25-44.

de Jong, P., & van der Leij, A., (1999). Specific contributions of phonological abilities to early reading acquisition: Results from a Dutch latent variable longitudinal study. *Journal of Educational Psychology*, 91, 450- 476.

Keuning, J., & Verhoeven, L., (2007). Spelling development throughout the elementary grades: The Dutch case. *Learning and Individual Differences* 18, 459–470. doi:10.1016/j.lindif.2007.12.001

Kivinen, O., Hedman, J., & Kaipainen, P., (2007). From elite university to mass higher education: Educational expansion, equality of opportunity and returns to university education. *Acta Sociologica*, 50, 231- 248. DOI: 10.1177/0001699307080929

Kupari, P., & Törnroos, J. (2006). Characterising Students' Mathematical Literacy Performances in Nordic Countries.

In J. Mejdning, & A. Roe (Eds.), *Northern Lights on PISA 2003: A Reflection from the Nordic Countries*, (Nordic Council of Ministers). (pp. 35- 47). Skive: Arco Grafisk a/s.

Landerl, K., & Moll, K., (2010). Comorbidity of learning disorders: prevalence and familial transmission. *Journal of Child Psychology and Psychiatry* 51, 287–294. doi:10.1111/j.1469-7610.2009.02164.

Leinonen, S., Müller, K., Leppänen, P. H. T., Aro, M., Ahonen, T., & Lyytinen, H. (2001). Heterogeneity in adult dyslexic readers: Relating processing skills to the speed and accuracy of oral text reading. *Reading and Writing: An Interdisciplinary Journal*, 14, 265-296.

Lent, R., & Brown, S., (1996). Social cognitive approach to career development: An overview. *The Career Development Quarterly*, 44, 310- 321.

Linnakylä, P., Malin, A., Blomquist, I., & Sulkunen, S., (2000). *Lukutaito Työssä ja Arjessa: Aikuisten Kansainvälinen Lukutaitotutkimus Suomessa*. Jyväskylä: ER-paino Ky.

Linnakylä, P., Malin, A., & Taube, K. (2006). What Lies Behind Low Reading Literacy Performance?

In J. Mejding, & A. Roe (Eds.), *Northern Lights on PISA 2003: A Reflection from the Nordic Countries*, (Nordic Council of Ministers). (pp. 159- 174). Skive: Arco Grafisk a/s.

Lyon, G. R., Shaywitz, S. E., & Shaywitz, B. A. (2003). A definition of dyslexia. *Annals of Dyslexia*, 53, 1–14.

Lyytinen, H., Erskine, J., Ahonen, T., Aro, M., Eklund, K., Guttorm, T., ... Viholainen, H. (2008). Early Identification and Prevention of Dyslexia: Results from a Prospective Follow-up Study of Children at Familial Risk for Dyslexia. In G. Reid, F. Manis, & L. Siegel (Eds.), *The Sage handbook of dyslexia*, 121–146. Thousand Oaks, CA: Sage.

Lyytinen, H., Leinonen, S., Nikula, M., Aro, M., & Leiwo, M. (1995). In search of the core features of dyslexia: Observations concerning dyslexia in the highly orthographically regular Finnish language. *Neuropsychology and Cognition*. 11. 177-204. doi: 10.1007/978-94-011-0385-5_6

Lyytinen, H., Ahonen, T., Aro, M., Aro, T., Holopainen, L., Närhi, V., & Räsänen, P., (2000). Kehitysneurologinen näkökulma oppimisvaikeuksiin.

In P. Fadjukoff, T. Ahonen, & H. Lyytinen, (Eds.), *Oppimisvaikeudet, tutkimuksesta käytäntöön = Learning disabilities, from research to practise*, (pp.) Jyväskylä: Niilo Mäki instituutti.

Ma, X., (2001). Participation in advanced mathematics: Do expectation and influence of students, peers, teachers, and parents matter? *Contemporary Educational Psychology* 26, 132–146. doi:10.1006/ceps.2000.1050

Madaus, J., Foley, T., McGuire, J., & Ruban, L. (2001). A follow-up investigation of university graduates with learning disabilities. *Career Development for Exceptional Individuals*. 24. 133-146. DOI: 10.1177/088572880102400204

Majoribanks, K., (2003). Family background, individual and environmental influences, aspirations and young adults' educational attainment: a follow-up study. *Educational Studies*, 29, 233-242.

Mau, W., & Bikos, L. (2000). Educational and vocational aspirations of minority and female students: A longitudinal study. *Journal of Counseling & Development*. 78. 186 – 194.

- McNulty, W., & Borgen, W., (1988). Career expectations and aspirations of adolescents. *Journal of Vocational Behavior*, 33, 217–224. [http://dx.doi.org/10.1016/0001-8791\(88\)90057-7](http://dx.doi.org/10.1016/0001-8791(88)90057-7)
- Mello, Z., (2008). Gender variation in developmental trajectories of educational and occupational expectations and attainment from adolescence to adulthood. *Developmental Psychology*, 44, 1069–1080. DOI: 10.1037/0012-1649.44.4.1069
- Monuteaux, M., Faraone, S., Herzig, K., Navsaria, N., & Biederman, J., (2005). ADHD and dyscalculia: Evidence for independent familial transmission. *Journal of Learning Disabilities*, 38, 86- 93.
- Murray. C.. Goldstein. D.. Nourse. S.. & Edgar. E.. (2000). The postsecondary school attendance and completion rates of high school graduates with learning disabilities. *Learning Disabilities Research & Practice*. 15. 119-127.
- Myrskylä, P., (2009). Koulutus periytyy edelleen, *Hyvinvointikatsaus*, 1, Henkilötilastot: Tilastokeskus. Retrieved from: http://tilastokeskus.fi/artikkelit/2009/art_2009-03-16_002.html
- Myrskylä, P., (2011). Nuoret työmarkkinoiden ja opiskelun ulkopuolella, (Työ- ja elinkeinoministeriö). Helsinki: Edita Publishing.
- Puolakanaho, A., Ahonen, T., Aro, M., Eklund, K., Leppänen, P., Poikkeus, A-M., Tolvanen, A., Torppa, M., & Lyytinen, H., (2007). Very early phonological and language skills: estimating individual risk of reading disability. *Journal of Child Psychology and Psychiatry* 48, 923–931. doi:10.1111/j.1469-7610.2007.01763.x
- Rimkute, L., Hirvonen, R., Tolvanen, A., Aunola, K., & Nurmi, J-E., (2011). Parents' role in adolescents' educational expectations. *Scandinavian Journal of Educational Research*, 56, 571–590. dx.doi.org/10.1080/00313831.2011.621133
- Rojewski. J., (1996). Occupational aspirations and early career-choice patterns of adolescents with and without learning disabilities. *Learning Disability Quarterly*. 19. 99-116.
- Rojewski. J., (1999). Occupational and educational aspirations and attainment of young adults with and without LD 2 years after high school completion. *Journal of Learning Disabilities* 32. 533-552. doi: 10.1177/002221949903200606

- Rojewski, J., (2005). Occupational aspirations: constructs, meanings and application. In S. Brown, & R. Brown (Eds.), *Career Development and Counseling: Putting Theory and Research to Work* (pp. 131-154). Hoboken, New Jersey: Wiley.
- Rojewski, J., & Kim, H., (2003). Career choice patterns and behavior of work-bound youth during early adolescence. *Journal of Career Development*, 30, 89-108. doi: 10.1023/A:1026150427009
- Rojewski, J., Lee, I., Gregg, N., & Gemici, S., (2012). Development Patterns of Occupational Aspirations in Adolescents With High-Incidence Disabilities. *Exceptional Children*, 78, 157-179.
- Rothon, C., Arephin, M., Klineberg, E., Cattell, V., & Stansfeld, S., (2011). Structural and socio-psychological influences on adolescents' educational aspirations and subsequent academic achievement. *Social Psychology of Education*, 14, 209-231. doi: 10.1007/s11218-010-9140-0
- Räsänen, P., & Ahonen, T. (2002). Matemaattiset oppimisvaikeudet.
 In H. Lyytinen, T. Ahonen, T. Korhonen, T. M. Korkman & T. Riita, (Eds.).
 Oppimisvaikeudet. Neuropsykologinen näkökulma. Helsinki: WSOY.
- Räsänen, P. & Leino, L. (2005). KTLT – Laskutaidon testi luokka-asteille 7-9. Jyväskylä, Niilo Mäki Instituutti.
- Salmela-Aro, K. (2010). Koulu-uupumus sosiaalisessa kontekstissa: Koulu, koti ja kaveripiiri. *Psykologia* 45,(05-06), 2010.
- Savolainen, H., (2001). Explaining mechanisms of educational career choice. A follow-up study of the educational career choices of a group of youths that finished compulsory education in 1990. Joensuu: Joensuun yliopisto, Kasvatustieteellisiä julkaisuja 69.
- 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. doi:10.1016/j.learninstruc.2007.09.017
- Schoon, I., & Parsons, S., (2002). Teenage aspirations for future careers and occupational outcomes. *Journal of Vocational Behavior*, 60, 262–288. DOI:10.1006/jvbe.2001.1867
- Sciarra, D., (2010). Predictive factors in intensive math course-taking in high school. *Professional School Counseling*, 13, 196-207. dx.doi.org.ezproxy.jyu.fi/10.5330/PSC.n.2010-13.196

Shafir, U., & Siegel, L., (1994). Subtypes of learning disabilities in adolescents and adults. *Journal of Learning Disabilities*, 27 123-134.

dx.doi.org.ezproxy.jyu.fi/10.1177/002221949402700207

Shalev, R., Manor, O., Kerem, B., Ayali, M., Badichi, N., Friedlander, Y., & Gross-Tsur, V., (2001). Developmental dyscalculia is a familial learning disability. *Journal of Learning Disabilities*, 34, 59- 65.

Shapka, J., Domene, J., & Keating, D., (2007). Trajectories of career aspirations through adolescence and young adulthood: Early math achievement as a critical filter. *Educational Research and Evaluation: An International Journal on Theory and Practice*, 12, 347-358. dx.doi.org/10.1080/13803610600765752

Simmons, F., & Singleton, C., (2008). Do weak phonological representations impact on arithmetic development? A review of research into arithmetic and dyslexia. *Dyslexia*, 14, 77-94. doi: 10.1002/dys.341

Suomen virallinen tilasto (SVT), (2011). *Palkkarakenne*. Helsinki: Statistics Finland. Retrieved from: http://www.stat.fi/til/pra/2011/pra_2011_2013-04-05_tie_001_fi.html

Super, D., (1990). A life-span, life-space approach to career development.

In D. Brown, & L. Brooks (Eds.), *Career Choice and Development: Applying Contemporary Theories to Practice* (2nd ed.), (pp. 197-261). San Francisco, CA, US: Jossey-Bass, xxi.

Taipale, A., (2009). Matematiikan, lukemisen ja kirjoittamisen vaikeuksien päällekkäistyminen nuoruusiässä, (Joensuun yliopiston kasvatustieteellisiä julkaisuja, 135). Joensuu: Joensuun yliopisto.

Torppa, M., Eklund, K., van Bergen, E., & Lyytinen, H., (2011). Parental literacy predicts children's literacy: A longitudinal family-risk study. *Dyslexia*, 17, 339–355. DOI: 10.1002/dys.437

Trusty, J., (2000). High educational expectations and low achievement: Stability of educational goals across adolescence. *The Journal of Educational Research*, 93, 356-365.

- Tynkkynen, L., Tolvanen, A., & Salmela-Aro, K. (2012). Trajectories of educational expectations from adolescence to young adulthood in Finland. *Developmental Psychology*. Advance online publication. doi: 10.1037/a0027245
- Vellutino, F., Fletcher, J., Snowling, M., & Scanlon, D. (2004). Specific reading disability (dyslexia): what have we learned in the past four decades? *Journal of Child Psychology and Psychiatry*, 45, 2-40. DOI: 10.1046/j.0021-9630.2003.00305.x
- Vukovic, R., Lesaux, N., & Siegel, L., (2010). The mathematics skills of children with reading difficulties. *Learning and Individual Differences* 20, 639–643. doi:10.1016/j.lindif.2010.08.004
- Väljärvi, J., Kupari, P., Linnakylä, P., Reinikainen, P., Sulkunen, S., Törnroos, J., & Arffman, I. (2007). *The Finnish success in Pisa-and some reasons behind it: Pisa 2003. 2*. Jyväskylän yliopisto, Koulutuksen tutkimuslaitos.
- Wolf, M., Bowers, P. G., & Biddle K. (2000). Naming-speed processes, timing, and reading: A conceptual review. *Journal of Learning Disabilities*, 33, 387-407. doi: 10.1177/002221940003300409
- World Health Organization, (2010). *International Classification of Diseases 10th Revision, (ICD-10)*. Retrieved from: <http://apps.who.int/classifications/icd10/browse/2010/en#>
- Zoccolotti, P., De Luca, M., Di Filippo, G., Judica, A., & Martelli, M., (2009). Reading development in an orthographically regular language: effects of length, frequency, lexicality and global processing ability. *Reading & Writing*, 22, 1053–1079. DOI 10.1007/s11145-008-9144-8