The Significance of Subject Preferences, Self-Efficacy Beliefs, and Gender for the Further Study Field Interests of Finnish General Upper Secondary School Students

RESEARCH

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ABSTRACT

This study examines how general upper secondary (GUS) students' school subject-specific preferences, mathematical and verbal self-efficacy beliefs, and gender, relate to students' university study field interests. A cohort sample of 601 students from ten Finnish GUS schools from Oulu answered a survey inquiring students current and further study interests. To investigate underlying factors regarding GUS students' educational interests, we adapted the Social Cognitive Career Theory (SCCT) as a theoretical baseline for this study. To examine factor structures behind the interests, a series of exploratory factor analyses, linear simple regression analyses, and cluster analyses were conducted. Findings showed that subject preferences and self-efficacy beliefs can, to some extent, predict interest in science & technology, service, health & education, and economics & social sciences. However, gender was found to be an overarching predictor of study field interest. Our results emphasize the need to develop gender-sensitive guidance methods and the importance of building such cooperation between school and working life that highlights anti-stereotypical role models. We also present suggestions for future research and concrete methods that would enable students to reflect on their current educational and career choices more broadly, based on their own strengths while being more aware of the directing influence of gender on their educational and career choices.

TIIVISTELMÄ

Tämä tutkimus tarkastelee, miten lukiolaisten oppiainekohtaiset mieltymykset, matemaattiset ja verbaaliset pystyvyysuskomukset ja sukupuoli ovat yhteydessä koulutusalakiinnostukseen. Lukio-opintoja ja jatko-opintotoiveita koskevaan kyselyyn vastasi 601 opiskelijaa Oulun alueen kymmenestä lukiosta. Tutkiaksemme koulutusalakiinnostuksen taustalla olevia rakenteita, toteutimme sarjan eksploratiivisia, kartoittavia faktorianalyysejä, lineaarisia muuttujien välisiä yhteyksiä tarkastelevia regressioanalyysejä ja ryhmitteleviä klusterianalyysejä aineistosta. Opiskelijoiden koulutusintressien taustalla olevien tekijöiden tutkimiseksi käytämme sosio-kognitiivista urateoriaa (SCCT). Tulokset osoittivat tiettyjen oppiainemieltymysten

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KEYWORDS:
upper secondary student; study field interest; subject preferences; self-efficacy; gender segregation; SCCT

AVAINSANAT:
lukio-opiskelija; koulutusalakiinnostus; ainemieltymykset; minäpystyvyys; sukupuolinen segregaatio; SCCT

TO CITE THIS ARTICLE:
Kaleva, S., Pursiainen, J., Celik, I., Peltonen, J., & Muukkonen, H. (2023). The Significance of Subject Preferences, Self-Efficacy Beliefs, and Gender for the Further Study Field Interests of Finnish General Upper Secondary School Students. *Nordic Journal of Transitions, Careers and Guidance*, 4(1), pp. 113–129. DOI: https://doi.org/10.16993/njtcg.56

ja matemaattisen tai kielellisen minäpystyvyyden osaltaan ennustavan koulutusalakiinnostusta koskien erityisesti tiede- ja teknologia-alaa, palvelu-, terveys- ja kasvatusalaa sekä talous- ja sosiaalitieteitä. Kuitenkin kaikista merkittävin ennustava tekijä yliopistojen koulutusalakiinnostuksen taustalla oli opiskelijan sukupuoli. Tuloksemme korostavat sukupuolisensitiivisten uraohjausmenetelmien kehittämisen tarvetta sekä sellaisen koulun ja työelämän yhteistyön rakentamisen tärkeyttä, joka nostaa esiin sukupuolisten stereotypioiden vastaisia roolimalleja. Esittelemme myös ehdotuksia tulevaa tutkimusta varten ja konkreettisia menetelmiä, joiden avulla opiskelijat voisivat pohtia nykypäivän koulutus- ja uravalintojaan laajemmin, omiin vahvuuksiin pohjaten ja tietoisempina sukupuolen ohjaavasta vaikutuksesta koulutus- ja uravalinnoissaan.

DOI: 10.16993/njtcg.56

INTRODUCTION

Making study field choices has become more complex than before: plethora of options, rapidly changing job market and uncertainty about the future make it difficult for students to choose what to study next (Maj-Waśniowska et al., 2023; Schwab 2017). Study field choices are recognized as some of the most crucial decisions in a person's life (Galotti, 1999). These choices bear substantial consequences not only for individuals but also for society. Selecting a study field is a complex process influenced by personal interests, passions, and family expectations. As a result, educational transitions have garnered research attention across diverse fields, encompassing education, psychology, sociology, and economics (Kim & Beier, 2020; Litalien et al., 2013; Salmela-Aro, 2020). This paper examines, through the lens of educational psychology, the underlying factors of general upper secondary (GUS) students' study field interest. Its focus is to examine the relationships between students' subject-specific preferences, mathematical and verbal self-efficacy beliefs, and gender in relation to their evolving interests in future study fields, before making their actual choices. The influence of these factors on disciplinary interests has received limited attention in prior research, making this study a valuable contribution that illuminates the factors influencing real-life decisions. In this study, we employ a cross-sectional research design to explore the foundational factors contributing to study field interests. Our investigation encompasses a cohort of 601 students drawn from ten GUS schools in Oulu, Finland.

Study field choice predicts career choice (Lent et al., 1994; Morris, 2016; Rounds & Su, 2014), work satisfaction and performance (Lent & Brown, 2006; Morris, 2003), subjective well-being (Harris & Rottinghaus, 2017), and life-satisfaction (Litalien et al., 2013). Making a study field choice is a complex and social process rather than an isolated individual event (Holmegaard et al., 2014) and the choice of further study field is influenced by several factors such as *gender, self-efficacy beliefs, interest, values, identity, and attitudes towards different school subjects* (Lavonen et al., 2008; Louis & Mistele, 2012; Nagy et al., 2006; Osborne et al., 2003; Schreiner & Sjøberg, 2007). Students' *social-cultural and socio-economic background factors* such as parental support and occupational role models (Porter & Umbach, 2006), *socio-economic status* (Ulriksen et al., 2015) and *regional location* (Helland & Heggen, 2018) have been also found to influence students' study field choices. Studies in U.S. have focused on examining the impact of students' background factors (ethnicity, gender, and social background) on study field choice (Iloh, 2018) while British studies have focused on understanding how students' different backgrounds such as their social class influences on study field choices and access to higher education (Ball, 2003; Reay et al., 2005). While the study field choice and its subsequent implications have been extensively explored, our emphasis lies in examining the fundamental aspects of disciplinary interest, which can vary significantly across different cultures. (e.g., Guan et al., 2015; Mau, 2000). Remarkably, the Nordic contexts present distinctive challenges concerning educational choices (Einarsdóttir & Rounds, 2020). Despite being globally recognized as some of the most egalitarian countries, these nations still grapple with significant gender segregation in both education and the workforce (World Economic Forum, 2020). The concept of the The "Nordic gender equality paradox" concept (Minelgaite et al., 2020) is often discussed in international comparisons, shedding light on the phenomenon where certain forms of gender segregation appear to be more prominent in highly gender-egalitarian and affluent

DOI: 10.16993/njtcg.56

countries (Stoet & Geary, 2018; Sund, 2015). This phenomenon is characterized by two distinct forms of segregation: 1) vertical segregation, where few women occupy top positions, and 2) horizontal segregation, marked by gender divisions among occupations and disciplines. This pattern seems to contradict the notion of gender equality as a widely acknowledged and embraced value (Corneliussen, 2021).

In our exploration of the underlying factors influencing GUS students' educational interests, we employ the Social Cognitive Career Theory (SCCT) as our foundational framework. SCCT is a relatively new theory that is aimed at explaining three interrelated aspects of career development: (a) how basic academic and career *interests* develop, (b) how educational and career *choices* are made, and (c) how academic and career *success* is obtained. The theory incorporates a variety of concepts (e.g., interests, abilities, values, environmental factors) that appear in earlier career theories and have been found to affect career development. SCCT is based on Albert Bandura's general social cognitive theory, and developed by Robert W. Lent, Steven D. Brown, and Gail Hackett in 1994. It is an influential theory of cognitive and motivational processes that has been extended to the study of many areas of psychosocial functioning, such as academic performance, health behaviour, and organizational development (SCCT in Greenhaus & Callanan, 2006).

Within SCCT, three fundamental variables, self-efficacy beliefs, outcome expectations, and goals, serve as the foundational "building blocks." The theory also posits that individuals acquire career-related information from their social environment, including parents, teachers, peers, and role models. This information, in turn, shapes their self-efficacy, outcome expectations, and personal goals. The goals are assumed to be affected by exposure to contextual supports and barriers, such as gender or ethnic background (Inda et al., 2013), and presence of support and the relative absence of barriers can directly and indirectly enhance choice goals. For understanding the supports and barriers behind educational choices, this study analyses the role of gender in study field interests. To date, only a few studies have examined the influence of gender on the cognitive-person variables of the SCCT model (Peña-Calvo et al., 2016). Previous studies indicate that outcome expectations were built through experience and gender might have more influence in shaping disciplinary interest among GUS students (Falco & Summers, 2019; Sadler et al., 2012). Hence our focus in this study is to investigate the role of gender in study field interests.

THE ROLE OF INTEREST IN STUDENTS' DISCIPLINARY CHOICES

Harackiewicz et al. (2016) articulated the term "interest" in educational contexts as a robust motivational force that invigorates learning, directs academic and career journeys, and plays a vital role in academic achievement. Interest is both a psychological state of attention and affect toward a particular object or topic, experienced in a particular moment (*situational interest*) and a continuing tendency to reengage over time (*individual interest*; Hidi & Renninger, 2006). Interest is a promising concept for analysing the foundations of disciplinary choices as it is an important internal factor energizing learning, guiding academic and career choices, essential to academic success, and directing the path of education as well as characterizing the individuals as unique persons (Vulperhorst et al., 2020). In their study Mikkonen et al. (2009) found that university students explained their disciplinary choices with their interest, however, studies suggest educators do not have a clear understanding of their potential role in helping students to develop interest (Hidi & Harackiewicz, 2000). In fact, it often has been misinterpreted in education that students either have or do not have interest, and not recognized that significant efforts could be directed at developing students' study and career interest (Kim & Beier, 2020; Nye et al., 2012; Smit et al., 2021).

Hanna and Rounds (2020) conducted a quantitative review of interest measures in the context of disciplinary choices to assess their validity in relation to interests and career decisions. Their study showed that interest inventories possess considerable validity for predicting career choice, reinforcing their value in research, education, and work contexts. Regarding the underlying factors of evolving interest, previous studies demonstrate that students' disciplinary interests are shaped by several individual and situational factors (Britner, 2008; Britner & Pajares, 2006; Hidi & Renninger, 2006; Lavonen et al., 2008; Louis & Mistele, 2012), and this research extends these previous findings by examining the significance of *subject-specific preferences, mathematic and verbal self-efficacy beliefs,* and *gender* on the *further study field interests* of Finnish GUS school students.

DOI: 10.16993/njtcg.56

GUS STUDENTS' SCHOOL SUBJECT-SPECIFIC PREFERENCES AND THEIR RELATION ON FURTHER STUDY INTERESTS

Subject-specific preferences, as evidenced in various studies (Barone, 2011; Cardador et al., 2021; Lent et al., 1994; Palmer et al., 2017), serve as predictive factors for both future academic pursuits and career interests. These preferences are highly individualized and are influenced by personal interests, past experiences, and future aspirations. Students' subject preferences can encompass specific school subjects (e.g., biology) or specific topics and activities within a subject area (e.g., studying the human brain's structure), a particular discipline (e.g., physiology), or even a specialized research field (e.g., ocean research) (Krapp & Prenzel, 2011). Additionally, students' preferences for particular school subjects (e.g., mathematics, languages) can vary depending on their willingness to engage with these subjects (Tempelaar et al., 2007). Hence, subject-specific preferences have been regarded as predictors of both educational and career interests (Lent et al., 1994). Additional research is required to investigate the connection between school subject preferences and future study interests. As Lavrijsen et al. (2021) suggest, studying subject preferences in younger individuals is particularly important, as the earlier students establish a clear understanding of their interests, the better equipped they will be to make informed study choices throughout their educational journey (p. 2).

In 2022, Leyva et al. surveyed college students to explore their interest in mathematics and various STEM careers, along with their perceptions of mathematics' role in those careers. They found that math interest predicted interest in many STEM careers but not all and that students' views on math's relevance to their chosen career influenced their interest in math and some STEM fields.

In a 2015 study by Linnansaari et al. on student participation in science classes, they found that girls generally favored life science over physical science, while boys had a stronger preference for physical science but were less inclined towards life sciences. Expanding on these prior findings, our initial investigation aims to evaluate students' subject preferences within the GUS education school curriculum. Students were asked to indicate their preferences for each school subject by rating them on a Likert scale from 1 to 5. (See Table 1).

THE RELATION OF MATHEMATICAL AND VERBAL SELF-EFFICACY WITH UNIVERSITY STUDY FIELD INTEREST

Psychologist Albert Bandura defined self-efficacy as individuals' belief in his or her ability to succeed in specific situations or accomplish a task (Bandura et al., 1999). Self-efficacy beliefs shape youths' aspirations and career paths, guiding their choices of potential careers and those they reject (Bandura et al., 2001). Self-efficacy has been shown to govern aspirations and development of educational and occupational interests (Betz & Hackett, 1997; Lent et al., 1994), and decades of research have demonstrated the power of self-efficacy on educational outcomes and performance (DiBenedetto & Schunk, 2018; Honicke & Broadbent, 2016; Louis & Mistele, 2012; Schunk & Pajares, 2004). In educational research, self-efficacy beliefs have received increasing attention regarding, for example, studies of academic motivation and self-regulation (Schunk et al., 2012).

Self-efficacy beliefs have been extensively studied in relation to mathematical skills (Seyranian et al., 2018; Vincent-Ruz & Schunn, 2018). Mathematical self-efficacy beliefs reflect students' confidence in their ability to perform specific academic tasks (Hackett & Betz, 1989; Pajares & Miller, 1995). Parker et al. (2014) discovered that self-efficacy independently and strongly predicts tertiary entrance ranks at the conclusion of GUS education. Extensive research has explored the link between mathematics self-efficacy and academic pathways, yet there remains a significant gap in understanding how self-efficacy beliefs relate to university study field interests. Our study addresses this gap by examining both mathematical and verbal self-efficacy beliefs and their connection to university study field interests. Field-specific gender segregation in higher education and occupations.

Gender is a well-recognized factor that significantly influences students' educational and career interests (Diekman et al., 2010; Kang et al., 2019; Kriesi & Imdorf, 2019). These influences are evident from early adolescence, as boys are more inclined to select mathematics and science tracks, while girls often opt for non-science tracks (Pinxten et al., 2012). Steegh et al. (2019)

DOI: 10.16993/njtcg.56

suggest that gender-based interest patterns in mathematics and science can manifest early in childhood, evolve over time, and impact course choices in GUS education. Within science subjects, boys often favour mathematics and 'hard science subjects' such as physics and chemistry, and girls prefer biology and geography (Eccles & Wang, 2016; Lavonen et al., 2008; Nagy et al., 2006; Schreiner & Sjøberg, 2007). Moreover, females often show less interest in STEM fields than males in many countries (Gaspard et al., 2019; Kaleva et al., 2019; Kriesi & Imdorf 2019; Wang & Degol, 2016). Research on gender segregation in specific fields in Iceland and Finland, despite their high rankings on international gender equality indices, reveals that both countries have some of the world's most gender-segregated labor markets (Einarsdóttir & Rounds, 2020). Since GUS student gender, especially in Nordic countries, has consistently proven to be a significant predictor of university study field and career interests (Mustosmäki et al., 2021), we incorporated this factor into our subsequent analysis.

THE PRESENT STUDY

In Finland, basic education spans from grades 1 to 9, mandatory for all children aged 7 to 17. Municipalities primarily provide free compulsory education, while private or state schools, though available, serve less than two percent of comprehensive school pupils (Ministry of Education and Culture, 2021). With the implementation of the compulsory education reform in August 2021, students now must apply for post-comprehensive school education at the end of their comprehensive schooling. They have the option to choose between General Upper Secondary Education (GUS) or vocational education. As its name suggests, GUS provides general education and does not qualify students for any occupation. GUS education usually takes three to four years to complete. At the end of GUS education, students take a national school-leaving examination known as the Finnish matriculation examination. Those who pass the examination are eligible to apply for further studies at universities or universities of applied sciences (Ministry of Education and Culture, 2021).

Our study focused on the GUS students in their second grade, a year before they apply to postsecondary education, addressing the questions: 1) How do GUS students' preferences on school subjects relate to university study field interest across genders? 2) What kinds of self-efficacy belief clusters (mathematical and verbal) can be found across genders? 3) How do these mathematical and verbal self-efficacy beliefs relate to university study field interest across genders?

Previous studies have shown that school subject preferences are connected to study and future career interest (e.g., Palmer et al., 2017), therefore we formed and tested the following hypotheses: H1) Preferences in GUS subjects have a relation to further study field interest. As previous research show that self-efficacy beliefs are related to further study field interest, (e.g., Bandura et al., 1999; Betz & Hackett, 1997; Lent et al., 1994), we formed a following hypotheses: H2a) mathematical and verbal self-efficacy belief clusters can be detected among GUS students, and it is related to university study field interests. As it is well known that gender is related to university study field interests (Diekman et al., 2010; Kang et al., 2019; Kriesi & Imdorf, 2019; Mozahem et al., 2020), we also hypothesized that H2b) clusters differ from each other's also by gender and it has a relation to university study field interest.

METHODS

DATA AND PARTICIPANTS

We used convenience sampling to recruit participants in one of Finland's largest cities. To enhance school diversity, we collected data from all ten schools in both rural and urban areas. A total of 643 GUS students participated, resulting in a 39% response rate. After excluding 42 respondents who didn't provide consent for their responses to be used in research, we had 601 responses for analysis. Approximately 60% of the participants were female, with an average age of 17 (SD = 0.97), which closely aligns with the target population (60% female, mean age 17). Cohort data was collected via an online survey in spring 2018 during school hours under teacher supervision. The survey included both quantitative (Likert scales) and qualitative (open-ended questions) data and took 20 to 40 minutes to complete. Respondents participated with their consent, following research ethics clearance procedures in their jurisdiction.

DOI: 10.16993/njtcg.56

MEASURES

The survey measured the relation of GUS students' *school subject (19 items) preferences* and *mathematic and verbal self-efficacy beliefs* (10 items) on *the interest on university study fields* (13 items). University study fields were drawn from the Fields of Education and Training classification (Unesco Institute for Statistics, 2013) (See Table 1).

I PREFER THE FOLLOWING SCHOOL SUBJECTS…	I AM INTERESTED IN THE FOLLOWING STUDY FIELDS…	WHAT DO YOU THINK ABOUT THE FOLLOWING STATEMENTS?
Mother tongue and literature	Education	I am good in mathematics.
Swedish	Arts and culture	I am interested in mathematical problem solving.
English	Humanities	I am good in my mother tongue.
Other foreign language	Social sciences	I like writing.
Mathematics	Economics, Administration, law	Mathematics requires effort from me, but I will learn all the necessary issues.
Biology	Natural sciences	I do not think I am good in mathematics.
Geography	Information technology and Electrical engineering IT communication	I get good grades from mathematics.
Physics	Technology	I learn mathematics fast.
Chemistry	Agriculture, forestry	I have always believed that mathematics is one of my strongest school subjects.
Philosophy	Medicine	In mathematics class, I can solve the most difficult problems.
Psychology	Health and well-being	
History	Service sector	
Social studies	Military sector	
Religion or ethics		
Health education		
Physical education		
Music		
Visual arts		
Student counselling		

Table 1 Measuring upper secondary students' school subject preferences, study field interest and mathematic and verbal self-efficacy beliefs.

Note: Measured with Likert scale 1–5, 1 = not at all 5 = very much.

DATA ANALYSIS

We initially screened the data for missing values and outliers with the aim of checking assumptions of statistical techniques. No outliers were observed. Regarding the normality assumption, both skewness and kurtosis coefficients were determined, and the coefficients were in an acceptable normal distribution range. In order to test the assumption of multicollinearity, we checked Pearson correlation values among dependent and independent variables and the variance inflation factor (VIF) and tolerance values (Tabachnick & Fidell, 2007). Test of assumptions yielded acceptable outcomes, meaning that the assumptions were met in term of regression and k-means cluster analysis. To explore the underlying factor structure of university study field interests and mathematics and verbal self-efficacy beliefs scales, a series of exploratory factor analyses (EFA) were conducted using the maximum likelihood (ML) extraction method with both varimax and promax rotations. Regarding university study field interest, the scale results suggested that the three factors (see Table 2) explaining 55.2% of the variance, should be retained. These factors represented three broad educational directions

DOI: 10.16993/njtcg.56

in university: *science and technology fields, service, health, and education fields* and *economics and social science fields.* Therefore, our further analysis focused on these factors although it excluded certain university fields, for example, the humanities or agriculture and forestry, that have more minor student intakes. The analyses indicated that for the mathematical and verbal self-efficacy beliefs scale, a two-factor solution explaining 69.6% of the variance of the empirical variables seemed the most plausible (see Table 2).

Table 2 The results of the factor analyses of study field interests and mathematical and verbal self-efficacy beliefs scales used in the study.

* ML factoring with promax rotation was used.

SCALES	FACTOR 1	FACTOR 2	FACTOR 3
Interest in study fields			
F1: *Interest in science and technology fields* (3 items; eigenvalue = 2.27; alpha = .75)			
Technology	.86		
Information technology and electrical engineering	.79		
Natural sciences	.55		
F2: *Interest in service, health and education fields* (4 items; eigenvalue = 2.19; alpha = .69)			
Health science and well-being		.88	
Service fields		.57	
Medicine		.55	
Education		.48	
F3: *Interest in economics and social science fields (2 items; eigenvalue = 1.74; alpha* = .81)			
Social science			.87
Business, administration, law			.77
Mathematical and verbal self-efficacy beliefs			
F1: *Mathematical self-efficacy beliefs* (6 items; eigenvalue = 4.18; alpha = .93)			
I am good in mathematics.	.90		
I learn mathematics fast.	.85		
In mathematics class I can understand the most difficult tasks.	.83		
I have always believed that mathematics is one of my strongest subjects.	.82		
I get good grades in mathematics.	.82		
I am interested in mathematical problems.	.78		
F2: *Verbal self-efficacy beliefs* (2 items; eigenvalue = 1.40; alpha = .79)			
I enjoy writing.		.95	
I am good in mother tongue.		.70	

A series of linear simple least squares regression analyses were run to assess the relative importance of subject preferences for the three university study fields interest subscales. To divide the sample into meaningful subgroups according to mathematical self-efficacy beliefs and verbal self-efficacy beliefs, a K-means cluster analysis was carried out. In the K-means cluster procedure, the number of clusters is chosen by the researcher, and cases are grouped into the cluster with the closest centre. Two-, three-, four- and five-cluster solutions were tested and evaluated based on both statistical criteria and the interpretability of the results. Based on the sample, we detected four separate clusters: *1) high math–low verbal, 2) low math–high verbal, 3) high math–high verbal and 4) low math–low verbal*. A chi-square test along with Cramer's V was used when exploring the relationships of gender and cluster membership. We used a two-way analysis of variance along with Gabriel's post hoc test to examine the data.

RESULTS

To test the first hypothesis, *H1) Preferences in GUS school subjects have a relation to university study field interest,* we performed a series of simple linear regression analyses where we predicted the GUS students' interest towards three main university study fields: *1) Science and*

technology, 2) service, health and education and 3) economics and social sciences with school subject preferences and *gender*, which were entered in the models as a dummy variable.

As for GUS students' interest in *science and technology* -fields, the more the respondent preferred the school subjects of physics, geography, mathematics, history, and chemistry, the more interested she or he was in studying science and technology at university. For male students, studying science and technology appeared to be more interesting than females (see Table 3).

VARIABLE	*B*	*SE B*	*β*
Physics	0.21	0.03	0.32***
Gender	–0.54	0.06	–0.28***
Geography	0.13	0.03	0.16***
Mathematics	0.12	0.03	0.16***
Chemistry	0.07	0.03	0.10*
History	0.05	0.02	0.07*
R^{2a}	0.50		
F	92.31***		

Table 3 Summary of the simple regression analyses for variables predicting interest in science and technology (N = 559).

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

Students' interest in the study fields of *service, health and education* was predicted by their preferences in the following GUS school subjects: *health studies, psychology, biology, student counselling, physical education and Swedish.* Also, for females, the study fields of *service, health and education* were more interesting than for males (see Table 4).

VARIABLE	*B*	*SE B*	*β*
Health studies	0.20	0.03	0.31***
Gender	0.40	0.06	0.23***
Psychology	0.12	0.02	0.16***
Biology	0.10	0.02	0.16***
Student counselling	0.10	0.03	0.14***
Physical education	0.06	0.02	0.09*
Swedish	0.04	0.02	0.07*
R^{2a}	0.42		
F	59.62***		

Table 4 Summary of simple regression analyses for variables predicting interest in service, health studies and education (N = 559).

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

Finally, the third regression analysis revealed that students' interest in the study fields of *economics and social sciences* was predicted by their preferences in the following school subjects: *social studies, physical education, English, and Swedish*. In this analysis, male students were more interested in studying economics and social sciences than female students (see Table 5).

VARIABLE	*B*	*SE B*	*β*
Social studies	0.45	0.02	0.65***
Physical education	0.06	0.02	0.09**
English	0.07	0.03	0.09**
Gender	–0.19	–0.10	0.08**
Swedish	0.05	0.02	0.08*
R^{2a}	0.50		
F	112.74***		

Table 5 Summary of simple regression analyses for variables interest in economics and social sciences (N =559).

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

DOI: 10.16993/njtcg.56

Next, we tested the second hypotheses *H2a) mathematic and verbal self-efficacy belief clusters can be detected among GUS school students and H2b) such clusters differ from each other's by gender, and they relate to university study field interest*. First, we explored what kinds of self-efficacy belief clusters (mathematical, verbal, high–low) can be found among GUS students by performing a K-means cluster analysis on the two self-efficacy beliefs subscale scores (mathematical self-efficacy and verbal self-efficacy beliefs). We performed several analyses with one through five classes and selected a four-class solution that was content wise and, in terms of parsimony, the best option.

The first self-efficacy belief cluster culled from our analysis was high math—low verbal (n = 134, 23.5%). On average, members of this group had a high scale score on mathematical self-efficacy beliefs and a relatively low scale score on verbal self-efficacy beliefs. The members of the second self-efficacy belief cluster (n = 164, 28.7%), low math—high verbal, typically scored low on mathematical self-efficacy beliefs and high on verbal self-efficacy beliefs. The third cluster, high math—high verbal (n = 113, 19.8%), had high average scores on both mathematical and verbal self-efficacy beliefs, whereas the members of the fourth group, low math—low verbal self-efficacy belief (n = 160, 28.0%), typically scored low on both self-efficacy belief subscale scores.

A chi-square test along with Cramer's V was performed to detect the differences between gender and self-efficacy belief clusters. We found a statistically significant relationship between gender and cluster membership. The distributions of the genders and the results of the test are presented in Table 6.

Table 6 Self-efficacy belief cluster membership by gender. $\chi^2(3, 559) = 27.65, p < .001$, Cramer's V = .22.

	GENDER	
CLUSTER	**MALE**	**FEMALE**
High math–low verbal (n = 131)	74 (56.5%)	57 (43.4%)
Low math–high verbal (n = 162)	44 (27.2%)	117 (72.8%)
High math–high verbal (n = 111)	42 (37.8%)	69 (62.2%)
Low math–low verbal (n = 155)	54 (34.8%)	101 (65.2%)

As can be seen from Table 6, most members of the high math–low verbal cluster are males, whereas the majority of the low math–high verbal cluster are females. As for the third and fourth clusters, females have a relatively larger proportion in both. However, it is important to note that the total of female participants (n = 344) is higher than the total of male counterparts (n = 214).

TESTS OF BETWEEN-SUBJECTS' EFFECTS

We used a two-way analysis of variance to examine the *combined effect* of gender & cluster membership and the interest towards *science and technology fields, service, health, and education fields* and *economics and social science fields*. None of the analyses showed a significant effect of *gender* combined with *self-efficacy belief* cluster membership on the interest in the study fields. There was no significant interaction in any of the analyses when the effects of gender and self-efficacy belief cluster membership *were combined* with the dependent variables (see Table 7).

Table 7 The effect of gender and self-efficacy belief cluster membership on further study fields interests.

	SS	df	MS	F
DV: Interest in science and technology fields				
Gender	76.95	1	76.95	133.99***
Cluster membership	37.623	3	12.53	21.81***
Gender * Cluster membership	3.27	3	1.09	1.90
Error	316.63	551	.58	
Total	465.50	558		

(Contd.)

DOI: 10.16993/njtcg.56

	SS	df	MS	F
DV: Interest in service, health, and education fields				
Gender	36.81	1	31.49	41.24***
Cluster membership	3.50	3	1.17	1.53
Gender * Cluster membership	.59	3	.19	.24
Error	420.64	551	.75	
Total	457.58	558		
DV: Interest in economics and social science fields				
Gender	22.40	1	22.40	29.31***
Cluster membership	15.81	3	5.27	6.89***
Gender * Cluster membership	4.82	3	1.61	2.11
Error	421.19	551	.76	
Total	463.87	558		

However, we found that both gender and self-efficacy cluster membership had a statistically significant main effect on the two dependent variables: *science and technology fields, economics and social science fields*. As for gender, there was a statistically significant difference ($p < .001$) between males (M = .54, SD = .90) and females (M = –.34, SD = .74) on *interest in science and technology fields*. According to Gabriel's post hoc test, there was a **statistically significant ($p < .001$) difference between the clusters**:

- between the high math-low verbal (M = .46, SD = .93) and the low math-high verbal (M = –.32, SD = .74) clusters,
- between ($p < .001$) the high math-low verbal (M = .46, SD = .93) and low math-low verbal (–.30, SD = .85) clusters,
- between ($p > .001$) the low math – high verbal (M = –.32, SD = .74) and the high math – high verbal (M = .33, SD .93) clusters,
- between ($p > .001$) the high math – low verbal (M = .46, SD = .93) and the low math – low verbal clusters (M = –.30, SD = 85) and
- between ($p > .001$) the high math – high verbal (M = .33, SD .93) and low math – low verbal (M = –.30, SD = 85) clusters (see Figure 1).

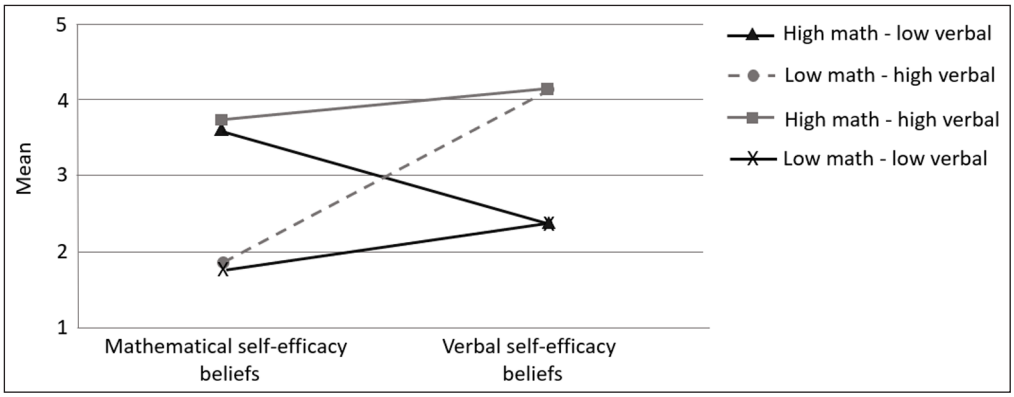

Figure 1 Mean score of the clusters.

We found statistically significant main effects of gender on interest in service, health, and education. On average, females (M = .20, SD = .91) had a higher mean score on the interest in service, health, and education ($p < .001$) than males (M = –.29, SD = .81), (4 items; eigenvalue = 2.19; alpha = .69). Cluster membership did not have a significant effect on interest in service, health, and education fields.

Finally, separately the gender and membership clusters explained a statistically significant portion of the variation in the interest in the economics and social science fields subscale score. On average, males (M = .22, SD = .86) scored higher ($p > .001$) on interest in economics

DOI: 10.16993/njtcg.56

and social science fields than females (M = –.13, SD = .91). A post hoc analysis with Gabriel's test indicated that there was a statistically significant difference (study field interest. $p < .01$) between the high math–low verbal (M = –.09, SD = .84) and low math–high verbal (M = .23, SD = .91) clusters and between ($p < .0019$ the low math–high verbal (M = .23, SD = .91) and low math–low verbal (M = –.19, SD = .92) clusters. Overall, the results support our hypothesis that the clusters differ from each other in terms of university study field interest.

DISCUSSION

The aim of this study was to examine the significance of GUS students' subject preferences, mathematical and verbal self-efficacy beliefs, and gender for the further study field interests. The main achievements, including contributions to the field can be summarized as follows: First, we found that interest towards *science and technology* -fields was predicted by preferring *physics, geography, mathematics, history, and chemistry*. Further, the interest towards *service, health and education* -fields was predicted with the school subjects of *health education, psychology, biology, student counselling, physical education and Swedish.* Additionally, *economics and social sciences fields were* predicted by preferring *social studies, physical education, English and Swedish*. Consistent with the result of the current study, previous research also evidenced positive relationship between science domains and interests in science and technology (Naukkarinen et al, 2021). Interestingly, history and geography were found to be positive predictors of science and technology interest.

Second, regarding students mathematical and verbal self-efficacy beliefs, among our sample we detected four self-efficacy belief clusters that differ from each other: *1) high math–low verbal, 2) low math–high verbal, 3) high math–high verbal and 4) low math–low verbal.* A further analysis regarding the *gender* of students' self-efficacy beliefs clusters showed that most members of the high math–low verbal cluster were males, whereas most of the low math–high verbal clusters were females. As for the high math–high verbal and low math–low verbal clusters, females constitute the largest proportion of both self-efficacy belief clusters. Similarly, McCabe et al (2019) found that females had more diverse, greater math and verbal abilities than males. Further, Wang et al. (2013) found in their study that that the group with high math skills and high verbal ability included more females than males, and their study provided evidence that it is not a lack of ability that causes women to pursue non-STEM careers but rather the greater likelihood that females with high math ability also had high verbal ability and thus could consider a wider range of occupations than their male peers with high math ability who were more likely to have moderate verbal ability.

Third, regarding *mathematical and verbal self-efficacy beliefs' relation to university study field interest,* we found a statistically significant relationship between *gender and self-efficacy belief* cluster membership, but none of the analyses showed a significant interaction effect of *gender combined with self-efficacy* belief cluster membership on the interest in the university study fields. That finding indicates that the interaction stem from gender with self-efficacy in math and verbal is not enough to explain the variance in university study field interest. Many researchers have attempted to better understand university study field interest through numerous variables (Blotnicky et al., 2018; Makarova et al., 2019; Mellén & Angervall, 2021). Since students` interests are regarded as complex psychological structures to predict, it is not easy to explain with combined effect from some variables (Jüttler et al., 2021). However, we found that both gender and self-efficacy cluster membership separately had a statistically significant main effect on the two dependent variables: *science and technology fields,* and *economics and social science fields*. Gender, examined with students mathematical or verbal self-efficacy beliefs, showed to be an overarching factor that impacted the study field interest: males were more interested in *science and technology* and females displayed more interest in *service, health and education study fields* than males. Addressing the gender gap in science and technology fields remains a concern (Cardador et al., 2021). Studies show that males are more inclined to opt for mathematics and science tracks, whereas females often gravitate toward non-science tracks (e.g., Pinxten et al., 2012). Even when females have interests aligned with STEM fields, the prospect of gender bias (Chen & Moons, 2015) can make them hesitant to pursue technology and science-based fields (Cardador et al. in 2021). According to our results, regardless of the other tested factors, *subject preferences* or *math-verbal self-efficacy beliefs*, students' gender overarchingly impact on GUS students' university study field interests.

DOI: 10.16993/njtcg.56

Our key findings suggest regardless of the other variables we investigated—such as subject preferences and self-efficacy beliefs in math and verbal skills—students' gender remains the dominant factor influencing the university study field interests of GUS students.

STRENGTHS AND LIMITATIONS

The sample size was adequate for obtaining more precise mean values and detecting potential outliers that might distort the data in a smaller sample, resulting in a reduced margin of error. Nevertheless, it is crucial to acknowledge certain limitations when interpreting the findings of this study. Our results are based on a single measurement of interest that may change over time depending on, for example, the respondents age and incidents that impact their life paths (Bandura, 1982). This study examines certain factors related to GUS students' second-year university field interests but does not reveal their eventual third-year choices. Further longitudinal studies could provide deeper insights. Additionally, in our measures, the focus is more on studying mathematics, and within the self-reported data, there was only a limited amount of information about verbal self-efficacy issues.

CONCLUSIONS AND IMPLICATIONS

Our findings suggest that, above all else, students' interest in pursuing university study fields is primarily influenced by their gender, regardless of their self-efficacy beliefs or subject preferences. It is an important notion that despite students' individual subject preferences or their educational strength, students tend to choose the traditional gendered pathways in Finland as well as on other Nordic countries (Einarsdóttir & Rounds, 2020; Mustosmäki et al., 2021). Recently in Finland, many cities, educators, and work-life representatives have started to develop out-of-school programmes to assist in the wider offering of educational and occupational pathways. Falco & Summers (2019) suggest that the improvement of career decision self-efficacy by means of career development interventions to students could serve as an effective way to foster awareness of the impact of a gender in career development. Their findings further suggested the need for student counsellors to incorporate gender and other sociocultural issues into career counselling with adolescents.

Educational and vocational choices are critical decisions for individuals (Kim & Beier, 2020) as they have a far-reaching impact on individuals' lives (Lent et al., 1994; Morris, 2016; Rounds & Su, 2014), on work satisfaction and performance (Lent & Brown, 2006; Morris, 2003) and on individuals' subjective well-being (Harris & Rottinghaus, 2017). It is therefore important to ask, should the current counselling system be expanded? For example, knowledge of work life could play a more important role in educational paths from previous years and be more closely linked to the subjects studied at different education levels.

Work life has changed tremendously in recent years and current career counselling systems face the challenge of providing up-to-date information on changing and fragmented working life. Although the student counsellors are responsible for guiding students' vocational and educational choices, what would happen if also subject teachers would take part on collaborating more with working life with the GUS students? At least for a single student, it would open more and wider opportunities to see what skills and knowledge are currently needed in their working life. Moreover, it would serve the goals of teachers to motivate students to engage in subject studies when the connection would become more visible from school subjects to working life.

In Finland, the integration of school and work life collaboration into curricula began in 2004 following the Ministry of Education's introduction of entrepreneurship education strategies. Over the years, efforts to strengthen collaboration with the working world have been made. However, recent studies indicate that cooperation still lacks coordination and a systematic approach, and it often relies on informal interactions between individual stakeholders and institutions. As our society has become increasingly dependent on science (Palmer et al., 2017) and the need particularly for STEM skilled people constantly grows, teachers have central role in stimulating students' interests (Pinxten et al., 2012). According to previous studies, educators may not have a clear understanding of their potential role in helping students to develop interest (Hidi & Harackiewicz, 2000), and often it is misinterpreted that students either have or do not have interest. Studies have emphasized the potential for significant efforts in fostering

students' study and career interests (Kim & Beier, 2020; Nye et al., 2012; Smit et al., 2021). Consequently, we propose further exploration of this prospect for nurturing students' interests, potentially employing methods like school and work life interventions.

Research has demonstrated that formal or informal STEM learning environments, along with collaborations involving young individuals, can ignite their enthusiasm for STEM subjects. As an example, science teachers could take more frequent opportunities to integrate work-life collaboration into their teaching. Engaging in discussions with STEM professionals from the workforce could help stimulate students' interest in science. Such collaborations, whether in work or academic contexts related to science subjects, offer students a two-fold advantage: they provide a wider perspective on STEM career possibilities and direct learning about the requisite subjects and skills from industry or academic professionals.

Our findings highlight the dominating impact of gender on study field interests and the necessity for developing gender-sensitive career guidance methods. To reduce the gender gap in education and work life, it is essential to investigate and promote gender-sensitive methods to encourage students to follow their interests and competencies instead of taking the traditional gender-segregated occupational and educational paths.

DATA ACCESSIBILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

FUNDING INFORMATION

This study has received project funding from Finnish Ministry of Education and Culture (OKM/197/523/2016) and the Academy of Finland Profilation 7 project (352788). It also received funding grants from Finnish Cultural Foundation and the University of Oulu Scholarship Foundation.

COMPETING INTERESTS

The authors have no competing interests to declare.

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REFERENCES

Ball, S. J. (2003). *Class strategies and the education market: The middle classes and social advantage.* Routledge. DOI: https://doi.org/10.4324/9780203218952

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37*(2), 122. DOI: https://doi.org/10.1037/0003-066X.37.2.122

Bandura, A., Barbaranelli, C., Caprara, G. V., & **Pastorelli, C.** (2001). Self-efficacy beliefs as shapers of children's aspirations and career trajectories. *Child Development, 72*(1), 187–206. DOI: https://doi.org/10.1111/1467-8624.00273

Bandura, A., Freeman, W. H., & **Lightsey, R.** (1999). Self-efficacy: The exercise of control. *Journal of Cognitive Psychotherapy 13*(2), 158–166. DOI: https://doi.org/10.1891/0889-8391.13.2.158

Barone, C. (2011). Some things never change: Gender segregation in higher education across eight nations and three decades. *Sociology of education*, *84*(2), 157–176. DOI: https://doi.org/10.1177/0038040711402099

Betz, N. E., & **Hackett, G.** (1997). Applications of self-efficacy theory to the career assessment of women. *Journal of Career Assessment, 5*(4), 383–402. DOI: https://doi.org/10.1177/106907279700500402

Blotnicky, K. A., Franz-Odendaal, T., French, F., & **Joy, P.** (2018). A study of the correlation between STEM career knowledge, mathematics self-efficacy, career interests, and career activities on the likelihood of pursuing a STEM career among middle school students. *International Journal of STEM Education*, *5*(1), 22. DOI: https://doi.org/10.1186/s40594-018-0118-3

Britner, S. L. (2008). Motivation in high school science students: A comparison of gender differences in life, physical, and earth science classes. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching, 45*(8), 955–970. DOI: https://doi.org/10.1002/tea.20249

Britner, S. L., & **Pajares, F.** (2006). Sources of science self-efficacy beliefs of middle school students. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching, 43*(5), 485–499. DOI: https://doi.org/10.1002/tea.20131

Cardador, M. T., Damian, R. I., & **Wiegand, J. P.** (2021). Does More Mean Less?: Interest Surplus and the Gender Gap in STEM Careers. *Journal of Career Assessment, 29*(1), 76–97. DOI: https://doi.org/10.1177/1069072720930658

Chen, J. M., & **Moons, W. G.** (2015). They won't listen to me: Anticipated power and women's disinterest in male-dominated domains. *Group Processes & Intergroup Relations, 18*(1), 116–128. DOI: https://doi.org/10.1177/1368430214550340

Corneliussen, H. G. (2021). Unpacking the Nordic gender equality paradox in ICT research and innovation. Feminist encounters: *A Journal of Critical Studies in Culture and Politics, 5*(2), 25. DOI: https://doi.org/10.20897/femenc/11162

DiBenedetto, M. K., & **Schunk, D. H.** (2018). Self-efficacy in education revisited through a sociocultural lens. *Big Theories Revisited*, *2*, 117.

Diekman, A. B., Brown, E. R., Johnston, A. M., & **Clark, E. K.** (2010). Seeking congruity between goals and roles: A new look at why women opt out of science, technology, engineering, and mathematics careers. *Psychological Science, 21*(8), 1051–1057. DOI: https://doi.org/10.1177/0956797610377342

Eccles, J. S., & **Wang, M. T.** (2016). What motivates females and males to pursue careers in mathematics and science? *International Journal of Behavioural Development, 40*(2), 100–106. DOI: https://doi.org/10.1177/0165025415616201

Einarsdóttir, S., & **Rounds, J.** (2020). A quantitative review of gender differences in vocational interests in Iceland: Pervasive and persistent. *Nordic Journal of Transitions, Careers and Guidance, 1*(1). DOI: https://doi.org/10.16993/njtcg.29

Falco, L. D., & **Summers, J. J.** (2019). Improving career decision self-efficacy and STEM self-efficacy in high school girls: Evaluation of an intervention. *Journal of Career Development, 46*(1), 62–76. DOI: https://doi.org/10.1177/0894845317721651

Galotti, K. M. (1999). Making a "major" real-life decision: College students choosing an academic major. *Journal of Educational Psychology, 91*(2), 379. DOI: https://doi.org/10.1037/0022-0663.91.2.379

Gaspard, H., Wille, E., Wormington, S. V., & **Hulleman, C. S.** (2019). How are upper secondary school students' expectancy-value profiles associated with achievement and university STEM major? *A cross-domain comparison. Contemporary Educational Psychology, 58*, 149–162. DOI: https://doi.org/10.1016/j.cedpsych.2019.02.005

Greenhaus, J. H., & **Callanan, G. A.** (Eds.) (2006). Encyclopaedia of career development (Vol. 1). Sage. DOI: https://doi.org/10.4135/9781412952675

Guan, Y., Chen, S. X., Levin, N., Bond, M. H., Luo, N., Xu, J., ... & **Han, X.** (2015). Differences in career decision-making profiles between American and Chinese university students: The relative strength of mediating mechanisms across cultures. *Journal of Cross-Cultural Psychology, 46*(6), 856–872. DOI: https://doi.org/10.1177/0022022115585874

Hackett, G., & **Betz, N. E.** (1989). An exploration of the mathematics self-efficacy/mathematics performance correspondence. *Journal for research in Mathematics Education, 20*(3), 261–273. DOI: https://doi.org/10.5951/jresematheduc.20.3.0261

Hanna, A., & **Rounds, J.** (2020). How accurate are interest inventories? A quantitative review of career choice hit rates. *Psychological bulletin, 146*(9), 765. DOI: https://doi.org/10.1037/bul0000269

Harackiewicz, J. M., Smith, J. L., & **Priniski, S. J.** (2016). Interest matters: The importance of promoting interest in education. *Policy insights from the behavioral and brain sciences, 3*(2), 220–227. DOI: https://doi.org/10.1177/2372732216655542

Harris, K. L., & **Rottinghaus, P. J.** (2017). Vocational interest and personal style patterns: Exploring subjective well-being using the Strong Interest Inventory. *Journal of Career Assessment, 25*(2), 203–218. DOI: https://doi.org/10.1177/1069072715621009

Helland, H., & **Heggen, K.** (2018). Regional Differences in Higher Educational Choice? *Scandinavian journal of educational research, 62*(6), 884–899. DOI: https://doi.org/10.1080/00313831.2017.1307276

Hidi, S., & **Harackiewicz, J. M.** (2000). Motivating the academically unmotivated: A critical issue for the 21st century. *Review of educational research, 70*(2), 151–179. DOI: https://doi.org/10.3102/00346543070002151

Hidi, S., & **Renninger, K. A.** (2006). The four-phase model of interest development. *Educational Psychologist, 41,* 111–127. DOI: https://doi.org/10.1207/s15326985ep4102_4

Holmegaard, H. T., Ulriksen, L. M., & **Madsen, L. M.** (2014). The process of choosing what to study: A longitudinal study of upper secondary students' identity work when choosing higher education. *Scandinavian journal of educational research, 58*(1), 21–40. DOI: https://doi.org/10.1080/00313831.2012.696212

Honicke, T., & **Broadbent, J.** (2016). The influence of academic self-efficacy on academic performance: A systematic review. *Educational Research Review, 17,* 63–84. DOI: https://doi.org/10.1016/j.edurev.2015.11.002

Iloh, C. (2018). Toward a new model of college "choice" for a twenty-first-century context. *Harvard Educational Review, 88*(2), 227–244, 256. DOI: https://doi.org/10.17763/1943-5045-88.2.227

Inda, M., Rodríguez, C., & **Peña, J. V.** (2013). Gender differences in applying social cognitive career theory in engineering students. *Journal of vocational behavior, 83*(3), 346–355. DOI: https://doi.org/10.1016/j.jvb.2013.06.010

Jüttler, A., Schumann, S., Neuenschwander, M. P., & **Hofmann, J.** (2021). General or vocational education? The role of vocational interests in educational decisions at the end of compulsory school in Switzerland. *Vocations and Learning, 14*(1), 115–145. https://link.springer.com/article/10.1007/s12186-020-09256-y. DOI: https://doi.org/10.1007/s12186-020-09256-y

Kaleva, S., Pursiainen, J., Hakola, M., Rusanen, J., & **Muukkonen, H.** (2019). Students' reasons for STEM choices and the relationship of mathematics choice to university admission. *International Journal of STEM Education, 6*(1), 43. https://stemeducationjournal.springeropen.com/articles/10.1186/s40594-019-0196-x. DOI: https://doi.org/10.1186/s40594-019-0196-x

Kang, J., Hense, J., Scheersoi, A., & **Keinonen, T.** (2019). Gender study on the relationships between science interest and future career perspectives. *International Journal of Science Education, 41*(1), 80–101. DOI: https://doi.org/10.1080/09500693.2018.1534021

Kim, M. H., & **Beier, M. E.** (2020). The college-to-career transition in STEM: An eleven-year longitudinal study of perceived and objective vocational interest fit. *Journal of Vocational Behavior, 123,* 103506, 1–14. DOI: https://doi.org/10.1016/j.jvb.2020.103506

Krapp, A., & **Prenzel, M.** (2011). Research on interest in science: Theories, methods, and findings. *International Journal of Science Education, 33*(1), 27–50. DOI: https://doi.org/10.1080/09500693.2010.518645

Kriesi, I., & **Imdorf, C.** (2019). Gender segregation in education. In R. Becker (Ed.), *Research Handbook on the Sociology of Education* (pp. 193–212). DOI: https://doi.org/10.4337/9781788110426

Lavonen, J., Gedrovics, J., Byman, R., Meisalo, V., Juuti, K., & **Uitto, A.** (2008). Students' motivational orientations and career choice in science and technology: a comparative investigation in Finland and Latvia. *Journal of Baltic Science Education, 7*(2).

Lavrijsen, J., Tracey, T. J., Verachtert, P., De Vroede, T., Soenens, B., & **Verschueren, K.** (2021). Understanding school subject preferences: The role of trait interests, cognitive abilities and perceived engaging teaching. *Personality and Individual Differences*, *174*, 110685. DOI: https://doi.org/10.1016/j.paid.2021.110685

Lent, R. W., & **Brown, S. D.** (2006). Integrating person and situation perspectives on work satisfaction: A social-cognitive view. *Journal of Vocational Behavior*, *69*(2), 236–247. DOI: https://doi.org/10.1016/j.jvb.2006.02.006

Lent, R. W., Brown, S. D., & **Hackett, G.** (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior*, *45*(1), 79–122. DOI: https://doi.org/10.1006/jvbe.1994.1027

Leyva, E., Walkington, C., Perera, H., & **Bernacki, M.** (2022). Making mathematics relevant: An examination of student interest in mathematics, interest in STEM careers, and perceived relevance. *International Journal of Research in Undergraduate Mathematics Education* (pp. 1–30). DOI: https://doi.org/10.1007/s40753-021-00159-4

Linnansaari, J., Viljaranta, J., Lavonen, J., Schneider, B., & **Salmela-Aro, K.** (2015). Finnish students' engagement in science lessons. NorDiNa: *Nordic Studies in Science Education, 11*(2), 192–206. DOI: https://doi.org/10.5617/nordina.2047

Litalien, D., Lüdtke, O., Parker, P., & **Trautwein, U.** (2013). Different pathways, same effects: Autonomous goal regulation is associated with subjective well-being during the post-school transition. *Motivation and Emotion, 37*(3), 444–456. DOI: https://doi.org/10.1007/s11031-012-9328-z

Louis, R. A., & **Mistele, J. M.** (2012). The differences in scores and self-efficacy by student gender in mathematics and science. *International Journal of Science and Mathematics Education, 10*(5), 1163–1190. DOI: https://doi.org/10.1007/s10763-011-9325-9

Maj-Waśniowska, K., Stanienda, J., & **Wyrobek, J.** (2023). Challenges for the education system in the era of the fourth industrial revolution. In M. Plonka (Ed.), *Public Goods and the Fourth Industrial Revolution*. Taylor & Francis. DOI: https://doi.org/10.4324/9781003274681-7

Makarova, E., Aeschlimann, B., & **Herzog, W.** (2019, July). The gender gap in STEM fields: The impact of the gender stereotype of math and science on secondary students' career aspirations. *Frontiers in Education* (Vol. 4, p. 60). DOI: https://doi.org/10.3389/feduc.2019.00060

Mau, W. C. (2000). Cultural differences in career decision-making styles and self-efficacy. *Journal of vocational behavior, 57*(3), 365–378. DOI: https://doi.org/10.1006/jvbe.1999.1745

McCabe, K. O., Lubinski, D., & **Benbow, C. P.** (2019). Who shines most among the brightest? A 25-year longitudinal study of elite STEM graduates. *Journal of Personality and Social Psychology*. *119*(2), 390–416. DOI: https://doi.org/10.1037/pspp0000239

Mellén, J., & **Angervall, P.** (2021). Gender and choice: differentiating options in Swedish upper secondary STEM programmes. *Journal of Education Policy, 36*(3), 417–435. DOI: https://doi.org/10.1080/02680939.2019.1709130

Mikkonen, J., Heikkilä, A., Ruohoniemi, M., & **Lindblom-Ylänne, S.** (2009). "I study because I'm interested": University students' explanations for their disciplinary choices. *Scandinavian Journal of Educational Research, 53*(3), 229–244. DOI: https://doi.org/10.1080/00313830902917261

Minelgaite, I., Sund, B., & **Stankeviciene, J.** (2020). Understanding the Nordic gender diversity paradox. *TalTech Journal of European Studies, 10*(1), 40–57. DOI: https://doi.org/10.1515/bjes-2020-0003

Ministry of Education and Culture. (2021). https://minedu.fi/en/education-system

Morris, M. A. (2003). A meta-analytic investigation of vocational interest-based job fit, and its relationship to job satisfaction, performance, and turnover. *Dissertation Abstracts International: Section B: The Sciences and Engineering, 64*(5-B), 2428.

Morris, M. L. (2016). Vocational interests in the United States: Sex, age, ethnicity, and year effects. *Journal of Counseling Psychology*, *63*(5), 604. DOI: https://doi.org/10.1037/cou0000164

Mozahem, N. A., Kozbar, D. K., Al Hassan, A. W., & **Mozahem, L. A.** (2020). Gender differences in career choices among students in secondary school. *International Journal of School & Educational Psychology, 8*(3), 184–198. DOI: https://doi.org/10.1080/21683603.2018.1521759

Mustosmäki, A., Reisel, L., Sihto, T., & **Teigen, M.** (2021). Gendered labor market (dis) advantages in Nordic welfare States: Introduction to the theme of the special issue. *Nordic Journal of Working Life Studies, 11*(S7). DOI: https://doi.org/10.18291/njwls.129190

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*(4), 323–345. DOI: https://doi.org/10.1080/13803610600765687

Naukkarinen, J., Korpinen, K., & **Silventoinen, P.** (2021). Upper secondary school students' gendered interests in electronics and electrical engineering. *Research in Science & Technological Education,* 1–21. DOI: https://doi.org/10.1080/02635143.2021.2008342

Nye, C. D., Su, R., Rounds, J. & **Drasgow, F.** (2012). Vocational interests and performance: A quantitative summary of over 60 years of research. *Perspectives on Psychological Science, 7*(4), 384–403. DOI: https://doi.org/10.1177/1745691612449021

Osborne, J., Simon, S., & **Collins, S.** (2003). Attitudes towards science: A review of the literature and its implications. *International Journal of Science Education, 25*(9), 1049–1079. DOI: https://doi.org/10.1080/0950069032000032199

Pajares, F., & **Miller, M. D.** (1995). Mathematics self-efficacy and mathematics performances: The need for specificity of assessment. *Journal of Counseling Psychology, 42*(2), 190. DOI: https://doi.org/10.1037/0022-0167.42.2.190

Palmer, T. A., Burke, P. F., & **Aubusson, P.** (2017). Why school students choose and reject science: A study of the factors that students consider when selecting subjects. *International Journal of Science Education, 39*(6), 645–662. DOI: https://doi.org/10.1080/09500693.2017.1299949

Parker, P. D., Marsh, H. W., Ciarrochi, J., Marshall, S., & **Abduljabbar, A. S.** (2014). Juxtaposing math self-efficacy and self-concept as predictors of long-term achievement outcomes. *Educational Psychology, 34*(1), 29–48. DOI: https://doi.org/10.1080/01443410.2013.797339

Peña-Calvo, J. V., Inda-Caro, M., Rodríguez-Menéndez, C., & **Fernández-García, C. M.** (2016). Perceived supports and barriers for career development for second-year STEM students. *Journal of Engineering Education, 105*(2), 341–365. DOI: https://doi.org/10.1002/jee.20115

Pinxten, M., De Fraine, B., Van Den Noortgate, W., Van Damme, J., & **Anumendem, D.** (2012). Educational choice in secondary school in Flanders: The relative impact of occupational interests on option choice. *Educational research and evaluation, 18*(6), 541–569. DOI: https://doi.org/10.1080/13803611.2012.702991

Porter, S. R., & **Umbach, P. D.** (2006). College major choice: An analysis of person environment fit. *Research in Higher Education, 47*(4), 429–449. DOI: https://doi.org/10.1007/s11162-005-9002-3

Reay, D., David, M. E., & **Ball, S. J.** (2005). *Degrees of choice: Class, race, gender and higher education*. Trentham Books.

Rounds, J., & **Su, R.** (2014). The nature and power of interests. *Current Directions in Psychological Science, 23*(2), 98–103. DOI: https://doi.org/10.1177/0963721414522812

Sadler, P. M., Sonnert, G., Hazari, Z., & **Tai, R.** (2012). Stability and volatility of STEM career interest in high school: A gender study. *Science education, 96*(3), 411–427. DOI: https://doi.org/10.1002/sce.21007

Salmela-Aro, K. (2020). The role of motivation and academic wellbeing–The transition from secondary to further education in STEM in Finland. *European Review*, *28*(S1), S121–S134. DOI: https://doi.org/10.1017/S1062798720000952

Schreiner, C., & **Sjøberg, S.** (2007). Science education and youth's identity construction-two incompatible projects? In *The re-emergence of values in science education* (pp. 231–247). Brill Sense. DOI: https://doi.org/10.1163/9789087901677_020

Schunk, D. H., & **Pajares, F.** (2004). Self-efficacy in education revisited: Empirical and applied evidence. In D. M. McInerney & S. Van Etten (Eds.), *Big theories revisited* 4 (pp. 115–138). IAP.

Schunk, D. H., Meece, J. R., & **Pintrich, P. R.** (2012). Motivation in education: Theory, research, and applications. *Pearson Higher Ed.*

Schwab, K. (2017). World Economic Forum: *The fourth industrial revolution. Currency* (pp. 1–8).

Seyranian, V., Madva, A., Duong, N., Abramzon, N., Tibbetts, Y., & **Harackiewicz, J. M.** (2018). The longitudinal effects of STEM identity and gender on flourishing and achievement in college physics. *International Journal of STEM Education, 5*(1), 40. DOI: https://doi.org/10.1186/s40594-018-0137-0

Smit, R., Robin, N., De Toffol, C., & **Atanasova, S.** (2021). Industry-school projects as an aim to foster secondary school students' interest in technology and engineering careers. *International Journal of Technology and Design Education, 31*(1), 61–79. DOI: https://doi.org/10.1007/s10798-019-09538-0

Steegh, A. M., Höffler, T. N., Keller, M. M., & **Parchmann, I.** (2019). Gender differences in mathematics and science competitions: A systematic review. *Journal of Research in Science Teaching, 56*(10), 1431–1460. DOI: https://doi.org/10.1002/tea.21580

Stoet, G. & **Geary, D. C.** (2018). The gender-equality paradox in science, technology, engineering, and mathematics education. *Psychological Science*, *29*(4), 581–593. DOI: https://doi.org/10.1177/0956797617741719

Sund, B. (2015). Just an illusion of equality? The gender diversity paradox in Norway. *Beta, 29*(2), 157–183. DOI: https://doi.org/10.18261/ISSN1504-3134-2015-02-04

Tabachnick, B. G., & **Fidell, L. S.** (2007). Experimental designs using ANOVA (Vol. 724). Thomson/Brooks/Cole.

Tempelaar, D. T., Gijselaers, W. H., van der Loeff, S. S., & **Nijhuis, J. F.** (2007). A structural equation model analyzing the relationship of student achievement motivations and personality factors in a range of academic subject-matter areas. *Contemporary Educational Psychology*, *32*(1), 105–131. DOI: https://doi.org/10.1016/j.cedpsych.2006.10.004

Ulriksen, R., Sagatun, Å., Zachrisson, H. D., Waaktaar, T., & **Lervåg, A. O.** (2015). Social support and socioeconomic status predict secondary students' grades and educational plans indifferently across immigrant group and gender. *Scandinavian journal of educational research, 59*(3), 357–376. DOI: https://doi.org/10.1080/00313831.2014.965792

Unesco Institute for Statistics. (2013). ISCED fields of education and training 2013. *(ISCED-F 2013): Manual to accompany the International Standard Classification of Education*. Unesco.

Vincent-Ruz, P., & **Schunn, C. D.** (2018). The nature of science identity and its role as the driver of student choices. *International Journal of STEM Education, 5*(1), 48. DOI: https://doi.org/10.1186/s40594-018-0140-5

Vulperhorst, J. P., van der Rijst, R. M., & **Akkerman, S. F.** (2020). Dynamics in higher education choice: weighing one's multiple interests in light of available programmes. *Higher Education, 79*(6), 1001–1021. DOI: https://doi.org/10.1007/s10734-019-00452-x

Wang, M., & **Degol, J.** (2016). Gender gap in science, technology, engineering, and mathematics (STEM): Current knowledge, implications for practice, policy, and future directions. *Educational Psychology Review, 29*(1), 119–140. DOI: https://doi.org/10.1007/s10648-015-9355-x

Wang, M., Eccles, S. E., & **Kenny, S.** (2013). Not lack of ability but more choice: Individual and gender differences in choice of careers in science, technology, engineering, and mathematics. *Psychological Science, 24*(5), 770–775. DOI: https://doi.org/10.1016/j.ssresearch.2013.07.002

World Economic Forum. (2020). The global gender gap report 2020. World Economic Forum. https://www3.weforum.org/docs/WEF_GGGR_2020.pdf

TO CITE THIS ARTICLE:
Kaleva, S., Pursiainen, J., Celik, I., Peltonen, J., & Muukkonen, H. (2023). The Significance of Subject Preferences, Self-Efficacy Beliefs, and Gender for the Further Study Field Interests of Finnish General Upper Secondary School Students. *Nordic Journal of Transitions, Careers and Guidance*, 4(1), pp. 113–129. DOI: https://doi.org/10.16993/njtcg.56

Submitted: 01 September 2022
Accepted: 01 November 2023
Published: 30 November 2023

Nordic Journal of Transitions, Careers and Guidance is a peer-reviewed open access journal published by Stockholm University Press.