SOCIO-CULTURAL FACTORS CONTRIBUTING TO ADOLESCENTS’ GENDERED EDUCATION AND CAREER EXPLORATION IN STEM
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Kirsi Ikonen

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ABSTRACT

In Finnish education and labor market, occupational gender segregation is a persistent phenomenon. Segregation levels are high and stable especially in the fields of science, technology, engineering and mathematics (STEM), which are strongly male-dominated. Finland is, however, in an ever-growing need for STEM-skilled workers to sustain economic growth, correct the demographic dependency ratio and finance the welfare state. Labor markets in many other states in Europe and the United States of America have similar characteristics than those of Finland. Research into gendered career choices has concluded that rather from differences in innate aptitudes only, gendered choices in STEM originate from a complex system of intellectual abilities, achievement motivations, the influence of family, school and friends, as well as other socio-cultural factors.

This dissertation addresses the contribution made by socio-cultural factors to adolescents’ gendered education and career exploration in the fields of STEM. The present study has been designed to help to develop knowledge in this area by examining some of the ways in which social influences and cultural perceptions of gender-appropriateness of occupations affect Finnish adolescents’ education and career exploration. The study is composed of three sub-studies, each of which aims to explore the main topic from a particular viewpoint and also to complement each another. The expectancy-value theory of achievement-related choices was chosen to act as the main theoretical framework of this present dissertation, as it is one of the most successful theoretical contributions in the research into gendered academic and vocational choices.

The first sub-study deals with understanding the role of socializers, such as parents and teachers, in Finnish ninth-graders’ education and career exploration. The second sub-study is an investigation of the kinds of gender-related perceptions of occupations that Finnish ninth-graders have, according to themselves and according to their school guidance counsellors. With regard to sub-study 3, its aim was to
investigate how parents consider the role of gender in the education- and career-related discussions that they have had with their children, how much parents know about STEM career opportunities, and how aware they may be of the individual and societal consequences of occupational gender segregation.

These three sub-studies were conducted in 2014-2018 in the Eastern Finland region. A mixed-methods research approach was employed, making use of both qualitative and quantitative data-collection and data-analysis methods and multiple data sources. A statistical analysis was made of the ninth-graders’ quantitative survey data and the principles of qualitative content analysis research were used in the analysis of the ninth-graders’ survey responses, guidance counsellors’ interview responses, and parents’ survey responses.

Sub-study 1 revealed that parents play the most important role in adolescents’ education and career exploration and are also potentially the main mediators of gender stereotypes concerning occupations. School guidance counselling plays second fiddle to parents with regard to the amount of education- and career-related discussion that adolescents have with these two groups of socializers. Education- and career-related discussions between subject teachers and ninth-graders seemed to be minimal; only a couple of ninth-graders reported heeding their teachers’ advice to any significant extent when making such decisions, and most of the guidance counsellors interviewed supported this claim.

Sub-study 2 documented the fact that ninth-graders mostly referred to masculine physical dimensions when justifying certain occupations as more suitable for men than for women. Respectively, they generally referred to gender-typical interests when justifying certain occupations as more suitable for women than for men. One positive signal in this study was that no stereotypes regarding male superiority in maths, science and technology occurred in ninth-graders’ views. Boys presented more gender-stereotypical perceptions of occupations than did girls, and boys also considered that their own gender affected their occupational preferences more strongly than did girls. According to guidance counsellors, ninth-graders’ perceptions of occupations are still frequently highly gender-stereotypical in their impact on education and career choices.

In sub-study 3, a majority of the parents participating in the study did not consider their adolescent children’s gender to have an influence on the discussions of future education and careers that they had together. A majority of the mothers reported having discussions with their children about the influence of gender on educational and career choices. In contrast, a majority of the fathers had not brought up the gender aspect in their discussions with their children. Half of both the mothers and the fathers had discussed educational pathways and career opportunities in the fields of science, mathematics and technology with their children, even though the mothers felt that their personal knowledge of such careers was less than that of the fathers. Mothers were able to mention several of the consequences of occupational gender segregation on an individual and a societal level. They mentioned, for
example, the gender pay gap and the problems involved in national competitiveness and in unleashing the full innovative potential of the country. The present study also reveals that some of the fathers were practically dismissive in their attitudes to occupational gender segregation and its consequences.

Thus, this study is intended to contribute to existing research into the underlying socio-cultural influences on adolescents’ gendered education and career exploration and choices, especially in the fields of science, technology, engineering and mathematics. The results of the study may prove to be of use in the development of interventions related to career education that encourage adolescents to examine and challenge traditional gender roles and occupational gender stereotypes. In doing so, they may become more aware of the wide range of opportunities that careers in STEM have to offer. In addition, the present results may be helpful in the development of interventions that promote parents’ readiness to talk with their children about jobs in STEM, thus promoting conscious educational and career choices.

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Joensuu, 30th October 2020
Kirsi Ikonen

Against the run of the mill
Static as it seems
We break the surface tension
With our wild kinetic dreams
Curves and lines —
Of grand designs...

Rush – Grand Designs
LIST OF ORIGINAL PUBLICATIONS

This thesis is based on data presented in the following articles, referred to by the Roman Numerals I-III.


AUTHOR’S CONTRIBUTION

The author designed the data collection methods and collected data for sub-studies 1 and 2. She participated in designing the data collection method used in sub-study 3. The author had the main responsibility for the data analysis in sub-studies 1 and 2, and she participated in the analysis in sub-study 3. The author is primarily responsible for formulating the theoretical background of sub-studies 1, 2 and 3. The author has undertaken the major part of the writing of all of articles I-III.
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1 INTRODUCTION

When trying to decide what they want to be as adults, adolescents do not explore education and career alternatives in a social vacuum. Career development is a complex process influenced by the social and cultural environment. While observing what people around them are doing and interacting socially in their everyday lives, individuals construct their identity belief systems and negotiate their life courses, including their education and career choices. Close individuals such as parents, teachers and friends act as central conversation partners in these matters. In addition to those in adolescents’ immediate inner circles, others such as celebrities, athletes and social media influencers can also act as important role models and sources of education and career information. There is a long history of research into social and cultural influences on career development, and the issue of gendered career patterns has been found to be one of the most central aspects of the field. The present study aims at contributing to that research by examining in depth the socio-cultural factors that currently influence Finnish adolescents’ education and career exploration and potentially also influence their gender-stereotypical career trajectories.

1.1 MOTIVATION

Finland is a leading country in fostering gender equality (European Institute for Gender Equality [EIGE], 2017a; United Nations Development Programme [UNDP], 2017), but its young people still choose rather traditional careers. Despite the progress made in gender-equality legislation and despite the countless programmes and projects encouraging young people to challenge gender stereotypes in choosing a career, certain fields remain strongly female- or male-dominated. The most female-dominated fields in Finland are social work, healthcare and education, the proportion of women in these professional groups ranging between 80 and 90 per cent, depending on the field (Statistics Finland, 2018). Correspondingly, the fields of science, technology, engineering and mathematics (STEM) are clearly male-dominated (Statistics Finland, 2018). Female students are already under-represented in secondary-level vocational education in the fields of science and engineering, while in higher education they orientate towards the life sciences more often than the physical sciences, applied mathematics, or engineering (Statistics Finland, 2018).

Segregation levels in Finland are relatively high compared to many other EU countries. Eurostat data show that in 2013-2014 the share of women in STEM occupations was lower in Finland than in 11 other countries in the European Union. In the field of information and communication technologies the proportion of female workers was lower in Finland than in 16 of the then 27 other EU countries. (EIGE, 2017b)
At the same time, in Finland there is an ever-growing need for STEM-skilled workers in order to sustain economic growth, correct the demographic dependency ratio and finance the welfare state. According to surveys conducted by Technology Industries Finland, a total of 53 000 new technically skilled workers would be required in 2018-2021 (Technology Industries of Finland, 2018). Improving the skills and perspectives of half of the population is critical in increasing innovation potential and problem-solving skills, and also in improving an organization’s knowledge-base and competence in relation to the needs of any organization’s diverse target groups, such as customers or students.

Starting in 2000, the Organisation for Economic Co-operation and Development (OECD) Programme for International Student Assessment (PISA) has measured 15-year-olds’ ability to use their reading, mathematics and science knowledge and skills to meet real-life challenges. Over the years, these assessments have shown that gender differences in science and mathematics performance in Finland have been quite small. In 2015 PISA found that the performance of Finnish girls in mathematics was, for the first time, statistically slightly better than that of the boys, and similar results were found in the most recent PISA assessment in 2018. A growing body of research into gendered career choices has concluded that, rather from occurring as differences solely in innate aptitudes, gendered choices in STEM originate from a complex system of intellectual abilities, achievement motivations, the influence of family, school and peers, and also other socio-cultural factors (Wang & Degol, 2013).

In recent decades, a great deal of effort has been put into investigating why young people are relatively unenthusiastic about orientating towards the various STEM fields and why especially girls do not consider STEM to be suitable for them. It is, after all, essential that research should be maintained in this field. The present study has, in consequence, been designed to help to develop knowledge in this area by examining some of the ways in which social influences and cultural perceptions concerning the gender-appropriateness of occupations affect Finnish adolescents’ education and career exploration, that is, the process of learning about different educational and occupational alternatives and also about individuals’ career preferences in terms of interests, skills, and values. With regard to social influences, this study focuses in particular on examining the role played by parents, teachers, friends and other socializers in adolescents’ education and career exploration. In the context of this study, reference to perceptions of the gender-appropriateness of occupations is concerned with the judgements that frequently rate some occupations as more suitable for men and others as more suitable for women in terms of such factors as traditional gender role, skills, or interests. In addition, this study will discuss the ways in which the knowledge gained in the course of its research and writing could be used to promote the notion that STEM is indeed relevant to everyone, thus helping young people to recognise that careers in STEM have the potential to be social, creative and relevant to the modern world.
1.2 RESEARCH PROCESS

The research process started with an extensive literature review with the aim of obtaining an overview of both international and national research concerned with the socio-cultural factors influencing adolescents’ education and career exploration and final choices. By diving into the research on the topic, the research problem was developed: It was discovered that relatively little research has been carried out in Finland covering the factors underlying Finnish young people’s traditional career choices. Published studies of adolescents’ perceptions of the gender-appropriateness of occupations were especially marginal.

Hence, it was considered important to investigate different groups of people to gain new information about the socio-cultural factors that contribute to Finnish adolescents’ exploration of their potential educational and occupational careers. Several different groups of people, ninth-graders, school guidance counsellors and adolescents’ parents, were included in order to provide a flexible variety of recommendations for working with these target groups in pursuit of conscious education and career exploration that would ignore gender.

The study has been conducted in the form of three sub-studies, each with a detailed set of research questions. The studies have been labelled as follows:

1. The influence of parents, teachers, and friends on ninth-graders’ educational and career choices.
2. The gender-appropriateness of occupations considered by Finnish ninth-graders.
3. Gender and the STEM fields in educational and career-related discussions between parents and their adolescent children.

In the first sub-study, data was collected with the intention of investigating the role played by socializers such as parents and teachers in relation to Finnish ninth-graders’ education and career exploration and decision-making. Particular attention was paid to the extent to which ninth-graders consider that these socializers present occupational gender stereotypes. Another part of the data collected in sub-study 1 was subsequently used in an investigation of the various gender-related perceptions of occupations held by Finnish ninth-graders. This part of the study was based on both their own accounts and also those of their school guidance counsellors, where the topic of STEM occupations occurred in the course of their gender-related perceptions. In the third sub-study, two interrelated areas were explored: firstly, the ideas expressed by Finnish adolescent children’s parents about the role played by gender in educational and career choices; and secondly, parent-child discussions about such ideas, especially with regard to STEM career pathways.
The research was conducted under the *socialization paradigm*, which is one of the foundational paradigms used in shedding light on social phenomena. According to socialization paradigm social forces, rather than an individual’s genes or some component of their physiology, constitute the more dominant force in shaping human nature and, concomitantly, human behaviour (Tang, 2010).

### 1.3 RESEARCH AIMS

The primary aim of this study was to investigate aspects of the impact of socio-cultural factors on Finnish adolescents’ educational and career exploration, in particular from the perspective of the fields of STEM. In this study the influence of socializers is investigated by examining the role played by socializers in ninth-graders’ education and career exploration and decision-making.

With regard to parental influence on adolescents’ education and career exploration, much of the research done in the past has focused on parental beliefs concerning their children’s academic abilities and on parental expectations of their children’s success in academic and working life (Jacobs, Chhin, & Bleeker, 2006; Jacobs, Davis-Kean, Bleeker, Eccles & Malanchuk, 2005; Räty & Kasanen, 2007). However, little research has been done into how parents consider the role of gender in any of the education- and career-related discussions that they have had with their children, nor has much attention been paid to how much parents know about STEM career opportunities, nor into how aware they may be of the individual and societal consequences of occupational gender segregation. This study aims to fill this research gap by investigating parents’ ideas regarding these aspects.

In addition to the influence of parents, teachers and friends, earlier research concludes that the extent to which occupations are seen as gender-stereotyped is another significant factor affecting educational and career exploration and related decisions. It also suggests that individuals mostly prefer occupations that they think of as being gender-appropriate. There exists, however, little or no research on Finnish adolescents’ occupational gender stereotypes. Hence, it was decided that examination of Finnish adolescents’ thoughts about the gender-appropriateness of occupations is vital for trying to explain the traditional and gender-segregated educational and career choices they are making.

The present study, and especially this dissertation, aims at justifying the importance of continuing to work actively on inspiring and motivating children and young people, regardless of their gender, to give serious consideration to the fields of science, technology, engineering and mathematics, and to recognize the significant role played by socio-cultural factors in developing and supporting their interests and aspirations.
2 CHARACTERISTICS OF THE EDUCATION SYSTEM AND LABOUR MARKETS IN FINLAND AND GLOBALLY IN TERMS OF THE FIELDS OF STEM

In this section, firstly, the Finnish education system is explained briefly to introduce the range of typical educational routes that young people choose from on their way towards working life. Subsequently, the characteristics of Finnish education and the labour markets are reviewed, concentrating on educational and occupational gender segregation and also on the labour force projections from the perspective of the fields of science, technology, engineering and mathematics. This section sheds light on the reasons why more STEM professionals of all genders are required, both in Finland and globally. This section also sets out the basis of the rationale for paying attention to the socio-cultural factors contributing to adolescents’ gendered educational and career explorations, especially with regard to STEM career pathways.

2.1 THE FINNISH EDUCATION SYSTEM

Figure 1 represents an overview of the Finnish education system. Children under school-age are entitled to participate in early childhood education and care (ECEC), which compromises care, education and teaching to support children's balanced growth, development and learning. Local authorities are responsible for providing ECEC, which is tax funded, making it more affordable for families. There is also private early education. Within the framework of ECEC, children are taken care of and taught by early education teachers and children’s nurses with an academic degree in the field. The National Curriculum Guidelines on Early Childhood Education and Care in Finland, approved by the Finnish National Agency for Education, guides the planning and implementation of the contents of ECEC and functions as the basis for drawing up the local ECEC curricula. (Finnish Ministry of Education and Culture, 2019)

All children who are permanent residents in Finland are obliged to participate in compulsory education. Compulsory education starts with pre-primary education, beginning when a child turns six. Pre-primary education places an emphasis on the preparation for school itself. Subsequently, basic education starts at the age of seven and comprises nine years, ending at the age of fifteen. Compulsory education is for the most part free of charge. (Finnish Ministry of Education and Culture, 2020)
After completing nine years of compulsory basic education, adolescents can choose to continue their educational track either in general upper secondary education or in vocational education and training. General upper secondary education provides, by definition, a general education and does not qualify the student for any particular occupation. General upper secondary education is designed so that it typically takes three years for students to complete it. At the end of the general upper secondary education, students take a national matriculation examination. Those who pass the matriculation examination are eligible to apply for further studies at universities, universities of applied sciences and vocational institutions. (Finnish Ministry of Education and Culture, 2020)
In vocational upper secondary education and training, students acquire basic vocational skills in a particular field and the professional competence required for practical work life. Instruction in vocational institutions is very practical and designed to meet the needs of the labour market. On-the-job training at workplaces plays a central role in vocational studies. It takes three years to complete vocational studies, and after completing the qualification a student can complete further and more specialized vocational qualifications. Further and specialist vocational qualifications may be completed as competence-based qualifications, and preparatory training for these is provided. After completing a vocational qualification, individuals may continue their studies in higher education. Vocational education and training is publicly funded and mainly free of charge for the students. (Finnish Ministry of Education and Culture, 2020)

The Finnish higher education system consists of universities and universities of applied sciences. The mission of the universities is to conduct scientific research and provide education based on it, whilst the universities of applied sciences (UAS) provide more practical education that aims at responding to the needs of the labour market. At the universities, students can complete Bachelor’s and Master’s degrees. The completion of a Bachelor’s degree at a university takes three years and a Master’s degree an additional two years. Thereafter, students can continue with postgraduate degrees, that is licentiate and doctoral degrees. (Finnish Ministry of Education and Culture, 2020)

At the universities of applied sciences students complete UAS Bachelor’s degrees and UAS Master’s degrees. The target completion time for a UAS degree is between 3.5 and 4.5 years. The requirement for Master’s studies at a university of applied sciences is a UAS Bachelors’ degree or another suitable degree and at least three years of work experience after the completion of the previous degree. (Finnish Ministry of Education and Culture, 2020)

### 2.2 GENDER SEGREGATION IN FINNISH EDUCATION AND THE LABOUR MARKET

Gender segregation in education and labour market refers to a concentration of one gender in certain fields of education or occupations (horizontal segregation) or a concentration of one gender in certain grades, positions or levels of responsibility (vertical segregation). (EIGE, 2017b)

Despite the fact that Finland is one of the leading countries in fostering gender equality (EIGE, 2017a; UNDP, 2017), gender segregation in education and the labour market is one of the equality challenges that Finland is dealing with. Gender segregation levels in Finnish education and the labour market are noticeably high and strikingly more resilient especially in the fields of science, technology, engineering, and mathematics (STEM) (Statistics Finland, 2018). From the year 1980 onwards, each Finnish government has implemented a four-year gender equality
programme with mitigating occupational gender segregation being often one of the aims of the programme (Statistics Finland, 2018). In addition, a large number of development and research projects have been carried out in the course of recent decades by the actions of various institutions and organizations hoping to encourage young people to question gender stereotypes and make non-traditional career choices. Despite these endeavours, the phenomenon continues to thrive. The very brevity the projects may have contributed to the impermanence of any lasting changes. Gender divisions are rooted in the structures of the Finnish economy and culture, and any transformation of cultural practices is slow (Finnish Institute of Health and Welfare, 2020).

Gender segregation has been reduced least in vocational education and training. Female students are underrepresented especially in the fields of information and communications technology (ICT)1 and technology; in 2017 only 12 per cent of the new students participating in education in these fields leading to either initial vocational qualification or further and specialist vocational qualifications were women. In contrast, in the field of health and welfare in 2017 the share of women was 84 per cent (Official Statistics of Finland [OSF], 2017b)

In higher education women orientate towards the fields of the life sciences more often than towards the physical sciences, applied mathematics, or engineering. For example, in the universities of applied sciences, in 2017 only 16 percent of the students pursuing degrees in technology were women (OSF, 2017a). In the universities the proportion of women in the field of ICT was slightly over 20 per cent, while in the field of engineering, manufacturing and construction it was approximately 25 percent. Most striking is the fact that in 2018 women completed nearly 60 per cent of all university degrees (OSF, 2018). In working life itself, science and engineering are amongst the principal occupations practised by Finnish men, while social work, healthcare and education are strongly female dominant occupations (Statistics Finland, 2018).

Vertical segregation is also strong and persistent in Finland. There are clear differences between women and men in career progression and placement in the occupational hierarchy. Men are more likely to operate in the higher-status positions, in traditionally male and even in traditionally female occupations, while women are located in the lower ranks (Statistics Finland, 2018) and their career progression to higher positions is slower than in the case of men. With regard to the various different sectors of the economy, women are more frequently represented in public sector jobs, while men are more likely to be represented in private sector positions (Statistics Finland, 2018). Women’s over-representation in the public sector is mainly explained by women’s occupational choices, since they are more likely to take jobs in education and health care (Statistics Finland, 2018). Okun, Amalya, and Orna (2007) argue that

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1 In this dissertation the field of information and communications technology (ICT) is treated as a part of STEM, since ICT is a branch of technology and also falls under the natural sciences in many institutions of education.
people orientating to the public sector consider it more family-friendly than the private sector since in the public sector it is easier, especially for women, to combine a career and family life.

Some changes have indeed happened in the past thirty years in the Finnish labour markets as women’s participation in higher education has increased. Women have increasingly undertaken education in traditionally male-dominant occupations such as doctors and lawyers. On the other hand, gender segregation in the ICT professions has actually increased since the early 1990s as female representation in these fields has fallen from 37 per cent to 16 per cent. In addition, men have not started to orientate towards traditional female dominant jobs as eagerly as women have towards male-dominated fields. (OSF, 2020)

2.3 CHARACTERISTICS OF EDUCATION AND LABOUR MARKETS GLOBALLY FROM THE PERSPECTIVE OF STEM

Education and labour markets globally have similar characteristics to those seen in Finland. According to United Nations Educational, Scientific and Cultural Organization (UNESCO) (2017), more girls are in school today than ever before, but they do not always have the same opportunities as boys to complete an education of their choice and to benefit from it. The UNESCO report Cracking the Code: Girls’ and Women’s Education in STEM (2017) concludes that, globally, only 35 per cent of STEM students in higher education are women.

In the European Union, in the context of upper-secondary and post-secondary non-tertiary vocational education and also in tertiary education, the representation of women in ICT and engineering education stands at only 17 per cent, while it stands at 19 per cent in manufacturing and construction education, these being the most male-dominat ed fields within STEM (EIGE, 2017b). It should be noted that in 2004-2015 the proportion of women of all STEM graduates in the EU decreased from 23 to 22 per cent. On the other hand, the natural sciences, mathematics and statistics have generally sustained a gender balance amongst graduates (EIGE, 2017b).

According to PISA 2015 data, in the OECD countries an average of 25 per cent of boys and 24 per cent of girls reported that they expected to work in a science-related occupation (OECD, 2016). However, boys and girls tended to think of working in rather different fields of science: more boys envisaged their future careers as ICT professionals, scientists or engineers than did girls, whereas girls saw themselves becoming health professionals in greater numbers than did boys. The field of ICT seems to be especially unpopular globally amongst adolescent girls. In the PISA 2018 assessment an average of only 1 per cent of girls throughout the OECD countries reported that they wanted to work in ICT-related occupations, compared with 8 per cent of boys. In no PISA-participating country or economy did more than 3 per cent of girls report such an ambition (Schleicher, 2019).
Within the EU, STEM occupations are persistently segregated by gender, and in the last decade the situation has not improved. Throughout the European Union, jobs especially in the construction and related trades, electrical and electronics trades, metal, machinery and related trades, and ICT are almost exclusively male-dominant (EIGE, 2017b). In this respect, numerous occupations are commonly dominated by women, for example pre-primary education, nursing, personal care and domestic work. No progress in increasing male representation in the fields of education, health and welfare has been made during the past 15 years (EIGE, 2017b).

According to the United States National Science Foundation (2019), in the United States the computer sciences and engineering have the lowest proportions of female degree recipients in the broad fields of science and engineering. In mathematics, statistics, and the physical sciences the proportion of women ranges between 30-45 per cent of all degree recipients depending on their field, chemistry being the most popular amongst women. The United States Labor Force Statistics from the Current Population Survey (2018) records that female representation in the totality of US employment is extremely low in construction and maintenance occupations and likewise in many engineering-related occupations, ranging from a few per cent to 30 per cent, depending on the occupation. Jobs related to computers, mathematics and the physical sciences are still also clearly male dominated in the US. For example, of the total working in computer and mathematical occupations, only 26 per cent are women. (United States Department of Labor, 2018.)

Since the 1970s various EU and national initiatives have been adopted in attempts to make STEM fields and occupations more attractive to young people (Caprile, Dente, Sanz, & Palmén, 2015). Some of the recent initiatives that have tackled the issue include the Strategic Framework for Education and Training 2020 (ET 2020), the Europe 2020 Strategy for Jobs and Smart, Sustainable and Inclusive Growth, the EU’s Strategic Engagement for Gender Equality 2016–2019, and the European Pillar of Social Rights, which aims at securing social rights more effectively in support of fair and well-functioning labour markets (EIGE, 2017).

2.4 WHY DOES GENDER SEGREGATION IN STEM MATTER?

Gender segregation has various consequences on societal, economic and personal levels. Regarding the societal consequences, vertical segregation creates an imbalance of power in any society. Vertical segregation hampers the equality of women and men in decision-making at different levels in workplaces and in a range of different fields, and also impairs the full use of everyone’s talents in governmental policy-making (EIGE, 2017b). In addition, people with STEM skills possess more power than might be expected. Due to horizontal and vertical segregation in STEM, women are currently almost excluded from sustainable developments, for example, including ‘green’ employment opportunities that are emerging in the labour markets.
Lacking the skills of female labour impedes the faster and better-balanced development of the ‘green’ economy (OECD, 2014).

Moreover, with respect to the economic implications of gender segregation, the labour markets in many countries globally are currently suffering from STEM skill mismatch, meaning that there is a gap between job skills and the demands of the STEM-related labour markets. According to the European Centre for the Development of Vocational Training (Cedefop) (2016), the top five occupations for which critical skill shortages have major implications for economies throughout the European Union are ICT professionals, medical doctors, STEM professionals, nurses and midwives, and teachers (Publications Office, 2016). A major reason for the shortage of both ICT and STEM professionals is primarily an insufficient supply of graduates capable of meeting the increasing demand, which, together with low participation of women, makes the level of skill mismatch worse (Publications Office, 2016). In PISA 2015 assessment science was the subject area in which the mean gender differences in performance were the smallest in comparison with reading and mathematics (OECD, 2016). PISA 2015 data also revealed that in Finland the top performers in the sciences are more likely to be girls than boys (OECD, 2016). The fields of ICT, engineering and certain disciplines within the natural sciences, such as physics, currently lack the potential skills of girls and women since they are more likely to orientate towards the science professions related to medicine, biology and chemistry, or even completely different occupations unrelated to STEM (OECD, 2016).

In their review of existing research literature concerned with skill mismatches in general, Ganev, Nikolova, Nikolov, and Aleksiev (2018) conclude that the issue impacts on education, personal and aggregate productivity, labour market dynamics and outcomes, innovation capacity and competitiveness. In the STEM fields the skill requirements change fast as technological advances and international competition develop. The results of the Cedefop European Skills and Jobs Survey suggest that some 85 per cent of all EU jobs need at least a basic digital skills competence, since artificial intelligence, big data analytics, the internet of things and advanced robotics are all reshaping the world of work (Publications Office, 2015). Ganev et al. (2018) argue that European economies cannot afford to waste human capital given the current and long-term demographic trends the declining labour force and an ageing population – and hence effective labour allocation and the development of a skill-pool are crucial for ensuring the ability of businesses in the EU to continue to develop their innovation capacity and to withstand increasing competitive pressures. A more effective use of the reserves of labour and skills includes encouraging more women to study STEM subjects (Publications Office, 2015).

The importance of increasing female labour in the employ of technology companies has been also justified from a value-in-diversity perspective, which argues that diversity in employees’ demographic characteristics such as race and gender is beneficial for business and helps organizations achieve higher profits.
relative to their competitors with a homogenous group of employees. The superior outcomes of diversity are explained by the capitalization of individuality and group working and not leaning on lone thinkers or people that think alike. The field of technology has been argued to benefit from diversity in its workforce as such a policy leads to increased innovation and better problem-solving when employees with different backgrounds and different ways of thinking make a contribution to the shared task. In addition, a diverse workforce is more able to consider the different needs of an organization’s target groups, such as customers or students. (Herring, 2009)

Finally, with regard to the consequences on personal level of gender segregation, it has been argued that segregation in STEM partially sustains a gender pay gap. In 2017 women in the EU earned, on average, 16 per cent less per hour than men (European Commission, 2020). The gender pay gap has persisted even though women have a higher average level of education in most countries and in the EU as a whole (EIGE, 2017b). In the USA, women now make up the majority of college graduates, according to the Pew Research Center analysis of data from the U.S. Bureau of Labor Statistics (Fry, 2019). Occupational gender segregation is considered to be one of the main factors underlying the pay gap, since women are currently over-represented in industries with low levels of pay and under-represented in well-paid industries (EIGE, 2017b). For example, Korkeamäki and Kyyrä claim that at least half of the gender wage gap arises from labour market segregation while human capital differences by gender account for less than 10 per cent (Korkeamäki & Kyyrä, 2005). Other reasons behind the pay gap include under-valuation of women’s work, and an uneven distribution of child-care responsibilities (EIGE, 2017b). Fixed-term employment and long family leaves hamper women’s wage development. Women’s career development is slower than that of their male counterparts, and hence some part of the pay gap is argued to result from structural discrimination (Finnish Institution for Health and Welfare, 2020). The pay gap also affects women’s pensions. For example, in Finland women’s average pension is only 79 per cent of that of their male counterparts (Finnish Institution for Health and Welfare, 2020). The pay gap between male- and female-dominated fields is also detrimental because it may discourage men from entering female-dominated occupations and thus hamper the desired reduction of occupational segregation (EIGE, 2017b).

### 2.5 WHY DO WE NEED MORE PEOPLE IN STEM?

Some of the reasons for promoting the need for STEM-skilled labour in support of economic competitiveness and societal issues have been discussed in the previous section, but they will be addressed here in greater detail. The dominant economic model used in Finland is based on high competence and the availability of a skilled and high-quality workforce. This is a key factor in sustaining economic growth, correcting the demographic dependency ratio and financing the welfare state. The
largest industries in Finland are in the fields of technology, chemicals and forestry and their products account for approximately 80 per cent of Finnish exports (Official Statistics of Finland, 2019). Hence, a sufficient supply of STEM-skilled labour is particularly important.

In addition to Finland, the employment of STEM-skilled workers is increasing throughout the European Union and in the United States, while a large number of people working in the STEM fields will be retiring in the course of the coming decade (Caprile et al., 2015; National Science Foundation, 2019). Within the EU itself, there will be a need for approximately 7 million STEM workers between 2015 and 2025, two-thirds of whom will be replacing retiring workers (Caprile et al., 2015). Since the oldest members of the Baby Boomer generation turned 65 in 2011, approximately 10,000 people in the USA will have been turning 65 each day between 2010 and 2030 (Heimlich, 2010), and those retirements will have included a significant number of experienced STEM workers.

The need for an expanding STEM workforce is also noteworthy simply because the fields included in STEM are constantly expanding, with a concomitant rise in the need for new STEM-skilled workers in the new jobs. There is now a need for STEM-skilled labour to deal with challenges that did not exist only a few decades ago. To mention a few: the world has to deal with the rapidity of the rate at which climate change is proceeding and with the consequences of massive plastic production and disposal. There is a need to balance the energy portfolio in the face of increasing global demand. In addition, approximately 1 in 9 people around the world do not have enough to eat (Food and Agriculture Organization of the United Nations [FAO], 2017) and 1 in 3 people globally do not have access to clean water (World Health Organization and the United Nations Children’s Fund [WHO & UNICEF], 2017). Finding solutions to these massive humanitarian issues is crucial, and in addition to political commitment and targeted investments, having a sufficient supply of STEM-skilled people is vital in working with challenges of this kind.
3 SOCIO-CULTURAL FACTORS INVOLVED IN EDUCATION AND CAREER EXPLORATION

Meta-analyses produced in recent decades of gender differences in the performance of science and mathematics continue to suggest that the differences in abilities have narrowed and are now quite small. Indeed, in many cases female students have outperformed male students in these domains (Else-Quest, Hyde, & Linn, 2010; Hyde, Fennema, & Lamon, 1990; O’Dea, Lagisz, Jennions, & Nakagawa, 2018). Research into gendered career choices has concluded that rather than innate differences in aptitude, gendered choices in STEM originate from more complex system of attitudes, self-concepts, motivations, gender stereotypes and both direct and indirect social influences, all of which shape young people’s career goals (Wang & Degol, 2017). In this section a theoretical framework of socio-cultural factors in education and career exploration is structured to create a rationale for the study presented in this dissertation. First, a few of the most successful theoretical contributions of the research on gendered education and career choice in STEM are briefly reviewed, and the focus is then placed on the expectancy-value theory of achievement-related choices, which was chosen to be the main theoretical framework of the present study.

3.1 SUCCESSFUL THEORETICAL CONTRIBUTIONS TO THE PRESENT FIELD OF STUDY

In the history of research into the interweaving of the social, cultural, and psychological influences on gendered education and career choice one can separate out a few major contributions that attempt to explain the origins of the different aspirations of boys and girls. A brief overview is given here on these approaches as they have appeared in recent decades to make it easier to understand the aspects that different scholars have emphasized in their work and the ways in which socio-cultural influences on gendered career choices have been described in their theories.

3.1.1 Theory of circumscription and compromise

*Theory of circumscription and compromise* is a theory of career development developed in 1981 by the American psychologist Linda Gottfredson. The dilemma underlying this theory was that the reason why children differ in the kind of jobs they wish for depends on their gender and social class. This theory attempts to describe how and what kinds of developmental stages guide individuals in their vocational choice processes at a young age and aims to explain the formation of an individual’s views
of the career choices that are available for them. According to this theory, the individual builds a cognitive map of occupations by making observations and picking up occupational stereotypes from their social surroundings. Occupations are arrayed on this map according to sex-type, prestige level and field of work. While constructing this map, individuals start to decide which occupations are acceptable for them and which are not — occupations that fit with their own developing self-concept and occupations that do not. Gottfredson terms this progressive elimination of least undesired vocational alternatives circumscription, and the accommodation to constraints on implementing the most aspired-to alternatives as compromising (Gottfredson, 1981).

According to Gottfredson, young children have quite positive images of all of the occupations that they are aware of, but as their self-concept develops with age, their perception of acceptable occupations grows narrower. The first developmental stage takes place at the ages 3-5 and is characterized by an orientation towards size and power, where occupations are regarded as adult roles. The orientation to gender roles starts in the second stage, at ages 6-8, when even then children have developed gender-type occupations. Gottfredson argues that occupations that are unacceptable for one’s gender are the first to be ruled out of further consideration. The elimination of gender-wise unacceptable occupational alternatives can be explained with gender-role theories, according to which individuals internalize cultural gender-role expectations in their gender ideology, and adapt to the roles, behaviour, activities, and attributes that a given society may construct or consider to be appropriate and in so doing establish their identity (Akerlof & Kranton, 2000; Sinclair & Carlsson, 2013).

The third developmental stage, according to this theory, takes place at ages 9-13 and it is characterized by sensitivity to prestige and status, where an awareness of social class results in the elimination of occupations that are inappropriate, based on the perceived prestige desired (Gottfredson, 1981).

Gottfredson claims that the exploration of occupational alternatives in adolescence, from the age of 14 onwards, is done largely within the set of occupations that were regarded as acceptable in childhood according to the child’s more visible social attributes such as gender, social class, and intelligence, and a sense of what is available with reasonable effort (Gottfredson, 1981). In adolescence, the search of roles is, however, more conscious than at the earlier ages. In this developmental stage, more complex concepts such as interests, abilities, values, work-life balance and personality become relevant, while also excluding vocational options which do not fit with the individual’s self-image and identification with an appropriate field of work.

Gottfredson’s theory has so far been applied in a large number of empirical studies. The implications for counselling include incorporating atypical role models for elementary school students, a proactive shaping of choices for secondary school students, and an emphasis on prestige and sex-type considerations for all students.
and counselling clients (Brott, 1993). Gottfredson’s theory has also received some criticism since it does not explain how an individual learns about the masculine or feminine characteristics of occupations, nor how the individual learns what levels of prestige are related to particular occupations. Gottfredson emphasizes in her theory the importance of self-concept, but Krumboltz and Nichols (1990) claim that it is unclear how children learn to choose between occupations that match their self-concept.

3.1.2 Social cognitive theory

One of the most successful theoretical contributions in educational research that has added to our understanding of gendered career choices from a socio-psychological perspective is the social cognitive theory (Bandura, 1977, 1978, 1982, 1986, 2001; Bussey & Bandura, 1999). The psychologist Albert Bandura started working on this theory in the 1960s as the social learning theory by, and by 1986 it had evolved into the social cognitive theory. The main premise of the social cognitive theory is that learning occurs in a social context, in a dynamic and reciprocal interaction between the individual, the environment, and behaviour (Bandura, 1986).

Bandura emphasises in his theory the interaction between the social and psychological aspects that have an impact on self-efficacy, that is, individuals’ belief in their capacity to succeed in a particular task area or field of work. According to Bandura, this self-judged efficacy influences the range of career options that are being seriously considered, the degree of interest shown in them by the individual, and the career paths that are then pursued (Betz & Hackett, 1986; Lent & Hackett, 1987). Bandura concludes that judgments of self-efficacy are based on four principal sources of information; performance mastery experiences; vicarious experiences for judging capabilities in comparison with the performances of others; verbal persuasion and allied types of social influences that cause the individual to possess certain capabilities; and physiological states from which people partly judge their capability, strength, and vulnerability.

Compared to cognitivist theories, social cognitive theory pays considerable attention to the social influences affecting gender roles. Bandura argues that parents and other people in children’s social circles instruct children in the kinds of behaviour expected of girls and boys, and these kinds of differential practices restrain the career options for which women judge themselves to be efficacious. In their article (1999), Bussey and Bandura present an analysis of gender role development and functioning within the framework of social cognitive theory. According to Bussey and Bandura, gender conceptions are constructed from the complex mix of experiences and how they operate in concert with motivational and self-regulatory mechanisms and come to guide gender-linked conduct throughout the life course. The theory integrates psychological and sociostructural determinants within a joint conceptual structure. From this theoretical perspective, gender conceptions and roles
are the product of a broad network of social influences operating interdependently in a variety of societal subsystems. In 1994, social cognitive career theory emerged (Lent, Brown, & Hackett, 1994) as a specification of the general social cognitive theory to contribute an explanation of how an individual develops academic and vocational aspirations on the basis of three core tenets: self-efficacy, outcome expectations, and goal representations (Lent et al., 1994; Bandura, 1997; Lent and Brown, 2013).

3.1.3 Expectancy-value theory of achievement-related choices

Among the most successful theoretical contributions to the investigation of the psychological determinants of students’ academic and career choices is the expectancy-value theory of achievement-related choices (Eccles, 1984; Eccles et al., 1983; Meece, Parsons, Kaczala, & Goff, 1982). This theory is an expansion of the classic expectancy-value theory developed by John William Atkinson (1957) with the aim of understanding individuals’ achievement motivation. In the 1980s, Jacquelynne S. Eccles and her colleagues expanded this research into the field of education. Eccles et al. (1983) the expectancy-value theory of achievement-related choices describes students’ motivation in different learning contexts. According to this theory, there are two critical factors impacting students’ motivation, academic achievement, and choice of activities: their expectancies for success and subjective task values (Meece et al. 1982).

Eccles et al. (1983) argue that the expectancies for success and subjective task value develop over childhood and adolescence and are influenced by a combination of factors including the individual’s abilities, previous experiences, goals, self-concepts, and beliefs and environmental influences, such as cultural milieu, gender stereotypes and socializers’ beliefs and behavioural characteristics. Expectancies for success and subjective task values are interrelated factors in the way that expectancies for success often have an influence on an individual’s later task value. In other words, individual tends to value those tasks and fields of work in which they feel competent (Eccles & Wigfield, 2002; Wigfield & Eccles, 2002).

The expectancy-value theory of achievement-related choices is a widely accepted approach that explains academic achievement as well as educational and vocational choices and attainment. A number of scholars working in educational and developmental psychology and studying the development of achievement motivation have used this theory in their research (e.g. Schunk, Pintrich, & Meece, 2006; Weiner, 1992; Wigfield & Eccles, 1992; Wigfield, Tonks, & Klauda, 2009). It has provided the foundation for research into the socio-psychological factors influencing academic success, the pursuit of advanced educational opportunities, and particular career aspirations, including research into gendered aspirations for careers in STEM (Eccles, 2005, 2009; Wang, 2012; Watt, 2004; Watt et al., 2012). This theory has also been applied in research into interventions aiming at increasing adolescents’
participation in the STEM fields (e.g., Harackiewicz, Rozek, Hulleman, & Hyde, 2012; Hulleman & Harackiewicz, 2009). The expectancy-value theory incorporates factors such as the development of self-concept and the influence of socializers, and recognizes the importance of the cultural milieu, gender stereotypes and occupational gender segregation in their influence on adolescents’ and adults’ occupational choices. Hence, this theory was chosen to be the main theoretical framework for this present study. This theory will be reviewed more thoroughly in section 3.2, where an emphasis will be placed on examining the theory from the perspective of gendered academic and career choices in STEM.

3.1.4 Contributions made by international comparative assessments contained in research into socio-cultural factors influencing gendered academic and career interests

In recent years, rapid progress has been made in research on gendered career choices in STEM. International assessments such as the OECD Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS) have contributed significantly to this research field by using comparative cross-national data. Since 2000, PISA has been used to measure 15-year-olds’ ability to use their reading, mathematics and science knowledge and skills to meet real-life challenges. Besides measuring actual abilities, PISA is accompanied by background questionnaires for both students and principals, and there are optional questionnaires for parents and teachers (Nordisk Ministerråd, 2018). TIMSS, in turn, conducts comprehensive state-of-the-art assessments of mathematics and science for students in Year 4 and Year 8 (Australian Council for Educational Research [ACER], 2020). TIMSS assesses both content knowledge and the students’ ability to apply their knowledge, along with questionnaires for students, teachers, parents, and school principals on social background, learning environment, and conditions for learning (Nordic Council of Ministers, 2018).

The PISA 2018 assessment revealed that gender continues to have a significant influence on adolescents’ career aspirations. Among students who achieve high scores in the PISA tests, boys clearly expect to work in science and engineering more often than girls. The data also shows that high achievers do not always aim at achieving their full potential. High-performing young people from the most disadvantaged backgrounds are, on average, four times less likely to hold ambitious aspirations than those with high PISA scores from the most privileged social backgrounds (OECD, 2019). In PISA 2015 Finland was the only country in which girls are more likely to be top performers in science. Despite Finnish girls’ great learning outcomes, they still see themselves as more likely to work as health professionals rather than scientists, engineers, or information and communication professionals (OECD, 2016).

Schleicher (2019) claims in the PISA 2018 Insights and interpretations report that, while having narrowed the gender gaps in cognitive abilities, education may have
forgotten the social and emotional dimensions of learning that may have a stronger impact on children as they plan their future education and career. Schleicher points out that data from earlier PISA assessments suggest that girls may not get much encouragement from their parents to pursue a career in STEM. PISA 2012 revealed that parents were more likely to expect their sons, rather than their daughters, to work in STEM-related job, including in those cases where boys and girls performed equally well in mathematics and science. Schleicher (2019) argues that an effort is required by parents, teachers and employers to become more aware of their own conscious or unconscious biases so that they give girls and boys equal chances of success at school and beyond. In the case of preparing students for working life, PISA 2018 shows that girls are more likely than boys to obtain information about future education or careers through their own Internet research, while boys are more likely than girls to gain hands-on experience by working as interns, job shadowing, visiting a job fair or speaking to career advisers outside of school. Schleicher suggests that employers and guidance counsellors should do more to engage girls in learning about potential careers (Schleicher, 2019).

3.2 EXPECTANCY-VALUE THEORY OF ACHIEVEMENT-RELATED CHOICES EXPLAINING GENDERED CHOICES IN STEM

The expectancy-value theory of achievement-related choices (Eccles, 1984; Eccles et al., 1983; Meece et al., 1982) was chosen to act as the main theoretical framework of this present dissertation, as it is one of the most successful theoretical contributions in the research into gendered academic and vocational choices. In The expectancy-value theory of achievement-related choices the socialization processes linked to various cultural and social settings, such as school and family, are centrally recognized as influencing individual and gender differences in achievement related expectations and subjective task values. This theory has been examined especially from the perspective of parents’ and teachers’ influence on children’s beliefs and choices (Eccles, Adler, & Kaczala, 1982; Eccles, 1994; Eccles, 2007) and used and adapted in several other studies from the 1980s to the present investigating gendered academic and vocational choices, particularly in STEM, and providing empirical support for the theory (e.g. Eccles, 2005, 2009; Dick & Rallis, 1991, Lauermann, Tsai, & Eccles, 2017; Wang, 2012; Watt et al., 2012). Hence, this theoretical framework was considered to be in closest alignment with the aspirations of the present study, which are to examine in particular the influence of socializers and occupational gender stereotypes on adolescents’ education and career exploration from the perspective of STEM fields.

In the early 80s, Eccles and her colleagues proposed this theoretical framework in support of a description of the complex interplay of factors influencing gendered choices in mathematics courses and majors. They had discovered that earlier research
included a number of seemingly disconnected theories and lacked a comprehensive theoretical framework providing a more complete description of the factors influencing both individual and gender differences in educational, vocational and other achievement-related choices (Eccles et al., 1983; Eccles, 1994; Meece et al., 1982). In their paper introducing this theory, Eccles et al. (1982) first summarize the past research into achievement and course selection in mathematics, including research findings related to biological, socialization, attitudinal and affective factors. They then integrate these research findings into a theoretical model aimed at explaining individuals’ academic choices and decisions in general.

The latest version of the expectancy-value theory of achievement-related choices is presented in Figure 2 (Eccles & Wigfield, 2020). Basically, this model links academic choices to individuals’ expectations of success and to their perceptions of the relative value of various academic or vocational options. In addition, the model considers the relations of a wide range of factors that are hypothesized to influence these two constructs, including both individual and also structural factors. Finally, there is a feedback loop in the model that works across time from achievement-related performance and choices to the experiences that an individual undergoes (Eccles & Wigfield, 2020).

Examples of factors that are believed to have an influence on individuals’ expectations of success and subjective task value according to the theory posited by Eccles et al. include diverse psychological variables, such as perceptions of competence, perceptions of the difficulty of different tasks, and individuals’ goals and self-schema, together with their affective memories for different achievement-related experiences.
related events (Wigfield & Cambria, 2010). These beliefs, goals, and affective memories are influenced by individuals’ perceptions of other peoples’ attitudes to and expectations for them, and also by their own interpretations of their previous achievements. Individual’s perceptions and interpretations are influenced by a wide range of contextual and socio-cultural determinants. These include socializers’ (especially parents’ and teachers’) beliefs and behaviour, an individual’s specific achievement experiences and aptitudes, and the cultural milieu in which they live (Wigfield & Cambria, 2010).

Each of the major components of this model is described in detail in the work done of Eccles and her colleagues (Eccles et al., 1983; Meece et al., 1982), but as this present dissertation focuses in particular on the socio-cultural factors contributing to gendered career exploration, a brief overview will be presented here of the socio-cultural elements incorporated in the expectancy-value theory of achievement-related choices. In addition, the findings of the latest research providing empirical evidence for the theory will be reviewed to construct an up-to-date overview of the socio-cultural influences on gendered choices in STEM.

3.2.1 Socio-cultural factors influencing gendered choices in STEM according to the expectancy-value theory of achievement-related choices

According to the expectancy-value theory of achievement-related choices, all of the psychological variables that guide achievement-related choices are influenced by an individual’s experiences, cultural norms, and the behaviour and goals of the individual’s peers and important socializers, such as parents, teachers and school guidance counsellors (Eccles et al., 1982; Eccles, 1994). Eccles (1994) raises a rather similar idea as Gottfredson’s in her Theory of Circumscription and Compromise (1981, 2002), which suggests that, although individuals make academic and vocational selections from among several options, for several reasons they do not consider the full range of objectively available options. There may be options that are never considered because individuals do not know that they even exist. Some alternatives, in turn, are not considered seriously because individuals have dated or completely false information about of either the option itself or their competence to achieve the option (Eccles, 1994). Finally, some alternatives are not seriously considered because they may not match the individual’s gender role schema (Eccles, 1994). The behaviour and goals of socializers and their peers play a significant role in each of the above-mentioned ways, thus narrowing the individual’s perceptions of academic and vocational options that are accessible to them.

Parents, teachers and guidance counsellors in particular provide individuals with information about their academic and vocational options. At the same time, they often hold achievement expectations that differ in relation to boys and to girls (Eccles, Adler, & Kaczala, 1982; Bleeker & Jacobs, 2004; Eccles et al., 1993; Yee & Eccles, 1988). These expectations are present in the types of information and experiences that they
provide for the young people and in the ways in which they encourage or discourage them. These types of behaviour may well shape individuals’ perceptions of the particular academic and vocational options that are accessible to them (Meece et al., 1982; Eccles, Adler, & Kaczala, 1982; Eccles, 2007). For example, the study published by Bleeker and Jacobs (2004) provides empirical support to the claim that parents’ expectations for their adolescents are associated with the adolescents’ expectations of success in mathematics and science. Eccles and her colleagues’ investigations over the past four decades have concentrated particularly on the influence of parents and teachers, and their studies suggest that, because of the parents’ and teachers’ behaviour, girls may develop a lower expectation of their ability in mathematics and reduce their interest in maths-related courses and fields. This, in turn, is likely to lead to the alienation of talented females from math-related careers (Eccles, 1993, 1994; Eccles & Harold, 1992; Eccles, Adler, & Kaczala, 1982).

With regard to the socializers’ influence on an individual’s subjective task value in the context of STEM fields, a study by Harackiewicz, et al. (2012) provides empirical support to the claim that parents’ utility value of STEM has an influence on adolescents’ utility value of, and achievement behaviour in, STEM. Harackiewicz et al. have developed an intervention that aims at increasing parents’ utility value in STEM and helping parents to motivate their adolescents to study mathematics and science courses in high school. This intervention increased the participation in maths and science courses by students whose mothers had been assigned to this utility value intervention, in contrast to those in a control group. However, the intervention was most effective in increasing STEM course-taking by high-achieving daughters and low-achieving sons, whereas the intervention did not help low-achieving daughters (Rozek, Hyde, Svoboda, Hulleman, & Harackiewicz, 2015).

The influence of parents, teachers and school guidance counsellors can be also seen in the formation of an individual’s gender role schema, and gender roles are likely subsequently to influence the individual’s perceptions of the range of accessible academic and vocational alternatives, and also the individual’s achievement-related expectations and subjective task value (Eccles, 1994). Parents and other socializers, whose values are influenced by cultural stereotypes, may transmit stereotyped beliefs to adolescents and encourage them either to obey the traditional gender roles or the contrary, to break down the traditional norms (Martin, 1996; Phillips, 2000; Pollack 1998). Socializers’ influence can even result in high-achieving girls’ alienation from enrolling in advanced STEM courses because they believe it is more important for women to make occupational sacrifices for the family and to have jobs that help other people.

Peer influences are acknowledged in the expectancy-value theory of achievement-related choices. Fabes et al. (2014) conclude that peer influences on activity choices and interactions appear early in an individual’s development and may set the stage for later school experiences and academic trajectories. If peers reinforce traditional gender role behaviour patterns and values, girls and boys will probably engage in
different activities (Eccles, 1994). Eccles (1994) argues that peers can affect the individual’s academic and vocational exploration either by supporting or by withholding support from the different options that the individual considers. The influence of peers can be both direct, such as laughing at a girl who aspires to working in engineering, or more indirect, taking the form of being present in the anticipation that a future spouse may or may not be able to support the family financially and hence presenting the need to work in a job with a higher salary, for example (Eccles, 1994).

In conclusion, each of the social influences introduced in this section operate within the lives of western children and adolescents as they live in the cultural milieu within which traditional gender role stereotypes and stereotypes of subject matter and occupational characteristics still seem to thrive. Adaptation to the cultural gender roles may influence an individual’s world view so strongly, that activities regarded as more appropriate to the other gender are rejected without any serious consideration (Eccles, 1994). Socio-cultural influences can either encourage or discourage individuals from considering gender role stereotypic choices, but it seems that these kinds of influences reinforce stereotypical gender roles rather than attenuate them (Eccles, 1994).

4 METHODOLOGY AND SAMPLE

This section introduces the paradigm that has been applied in this study. This is followed by a brief introduction to the mixed-method study approach, and the application of the methodology in sub-studies 1-3 is then explained. The methodology and sample in sub-studies 1 and 2 are presented, since in these two studies the data was gathered by means of the same instruments and using the same sample. This is then followed by a description of the methodology and sample used in sub-study 3.

4.1 PARADIGM

When consideration was being given to the choice of the most effective paradigm for the present study, it was recognized that the characteristics of this study correspond more closely to social science research than typical educational research, even though the sample groups are middle school pupils, school guidance counsellors and parents. The difference between this study and a typical educational study is that its focus is not on learning, teaching methods, teacher training, or classroom dynamics but rather on the perceptions and views of the sample groups concerning adolescents’ education and career exploration. Within this context, its research findings were designated to be used in the various educational contexts that have
been described above. Hence, close attention was paid to the philosophy of the social sciences with the aim, firstly, of understanding the foundational paradigms used in shedding light on social phenomena and then to discover the kind of approach that would be the most suitable for tackling the complex system of socio-cultural factors influencing adolescents’ education and career exploration.

It was found that one of the foundational paradigms of social sciences is the socialization paradigm, according to which social forces, rather than an individual’s genes or some component of their physiology, constitute the more dominant force in shaping human nature and, concomitantly, human behaviour (Tang, 2010). The socialization paradigm opposes the paradigm of biological evolutionary determinism, which insists that the human mind has not started as a tabula rasa but that biological evolution has endowed the human mind with certain specific traits before the development of human society and that this human nature is not erasable by socialization (Tang, 2010).

Ontologically, the socialization paradigm contains two interconnected notions. Firstly, human behaviour is fundamentally constrained and shaped by the social system, especially its culture and institutions that are normally supported by a power structure. Secondly, human behaviour is fundamentally driven by individuals’ urge to conform and adapt to the social system—especially its institutions and culture. In turn, individuals’ conforming and adapting to society underpins a society’s stability. (Tang, 2010). Epistemologically, the socialization paradigm holds that individuals’ behaviour is best explained by a society’s constraints and by individuals’ urge to conform and adapt and thus satisfy themselves materially and psychologically. In turn, individuals’ conforming and adaptation to society explains a society’s stability (Tang, 2010).

According to Tang (2010), the socialization paradigm is only one of 11 foundational paradigms in the social sciences, each of which can only shed light on a limited area of human society. Different schools of social science research deploy these foundational paradigms either individually or in different combinations. These foundational paradigms are synthesized in the Social Evolution Paradigm (SEP) into an organic whole.

4.2 MIXED METHODS APPROACH

The present study employs a mixed methods research approach. Mixed methods research has emerged alongside quantitative and qualitative approaches as an important tool for researchers (Creswell & Garrett, 2008). A mixed methods research approach refers to a methodology that involves the integration of quantitative and qualitative data within a single investigation or sustained program of inquiry (Wisdom & Creswell, 2013). Such an approach combines various aspects of quantitative and qualitative research, such as different perspectives, intentions, research questions, data sources, analytical techniques and interpretations associated
with synthetic approaches of this kind. The main premise of a mixed methods approach is that this kind of integration facilitates a more complete use of data than that provided by separate quantitative and qualitative data collection and analysis (Wisdom & Creswell, 2013).

The four basic mixed methods designs include the convergent parallel design, the explanatory sequential design, the exploratory sequential design, and the embedded design. In addition to these four, other major designs include two examples of designs that bring multiple design elements together: the transformative design and the multiphase design. (Creswell & Plano Clark, 2011)

This present study design corresponds to the convergent parallel design. Figure 3 represents the prototype of such a design, based on work done by Creswell and Plano Clark (2011). First, the convergent design was conceptualized as a “triangulation” design standing for the two different methods being used to acquire triangulated results related to a single topic (Creswell et al., 2011). Triangulation, however, was often confused with the use of triangulation in qualitative research, and researchers have often used this design for purposes other than to produce triangulated findings. Since the 1970s this design has gone by many names, including simultaneous triangulation (Morse, 1991), parallel study (Tashakkori & Teddlie, 1998), convergence model (Creswell, 1999), and concurrent triangulation (Creswell, Plano Clark, Gutmann, & Hanson, 2003). Basically, convergent design advances the collection and analysis of both quantitative and qualitative data during the same phase of the research process, following which the two sets of results are merged into an overall interpretation.

![Figure 3. Prototypical Version of the convergent parallel design according to Creswell and Plano Clark (2011).](image-url)

The present study employs convergent parallel design in sub-studies 1 and 2 by collecting both qualitative and quantitative data from ninth-graders. In addition, in relation to the data collected in these studies, triangulation of multiple information sources is applied by collecting complementary data concurrently from ninth-graders’ school guidance counsellors. These data sets collected from ninth-graders and their school guidance counsellors were analyzed independently and the results
were then interpreted together. The data collection in sub-study 3, for its part, provides complementary data for one of the aspects of the whole study, that is, for the interpretation of the influence of parents on adolescents’ education and career exploration.

4.3 METHODOLOGY AND SAMPLE IN SUB-STUDIES 1 AND 2

This section introduces the data collection methods, sample, and data analysis methods used in sub-studies 1 and 2. Both qualitative and quantitative data was gathered in these studies, following a mixed methods study approach. In both of these sub-studies, data was gathered from the same sample, using the same data collection instruments: a survey and an interview protocol. The research data was subsequently divided into two parts according to the research questions that were set before the data collection. The data was also analyzed using slightly different methods in each sub-study. In this section, the data collection methods are introduced, followed by a presentation of the sample and finally by a description of the data analysis methods.

4.3.1 Data collection methods

Survey focusing on ninth-grade students

In sub-study 1 the aim was to investigate both the role played by socializers in relation to Finnish ninth-graders’ education and career exploration and also the extent to which both ninth-graders and their school guidance counsellors consider these socializers to possess occupational gender stereotypes. For its part, sub-study 2 aimed, firstly, at exploring the kinds of gender-related perceptions of occupations that Finnish ninth-graders have, according to their own views and also those of their school guidance counsellors, and secondly, how STEM occupations feature in these gender-related perceptions.

In relation to gathering data from ninth-graders, a comprehensive survey instrument (Trochim, 2006) was designed that included items for gaining knowledge relevant to both of the research aims mentioned above. The survey instrument was designed by a group of four researchers after they had performed an extensive review of earlier international and national research in the field and identified gaps in the research, especially in previous Finnish research concerned with the role played by socializers and occupational gender stereotypes in adolescents’ education and career exploration. A survey instrument was constructed consisting of demographic questions, Likert-scale statements, and comment boxes to be completed with students’ justifications of their Likert statements. The survey was then administered online to make it easier to distribute to pupils.

The first version of the survey was piloted with 73 ninth-grade pupils from one school located in Southern Finland, with the help of a school guidance counsellor.
working at the school. In the pilot survey instrument, pupils were allowed and, indeed, encouraged to write down their feedback about the survey. In addition, the pupils’ guidance counsellor was asked to report their experiences concerning the pilot study. Based on the feedback from pupils and their guidance counsellor, one question was reformulated to make it unambiguous. It took approximately 30 minutes for pupils to complete the survey, which was considered a reasonable amount of time.

For the actual data-gathering, 24 school guidance counsellors in the Eastern Finland region were contacted and asked to conduct the survey during their ninth-graders’ school guidance counselling lessons in the autumn of 2014. A total of eight guidance counsellors agreed to conduct the survey during their own classes. Their pupils were offered a chance to refuse to participate in the study, but none of them did so.

*Interview protocol for school guidance counsellors*

In order to supplement the ninth-graders’ survey data, guidance counsellors’ views were explored via interviews. An interview protocol (Galletta, 2013) was designed by the group of four researchers, guided by the literature review and their aim to fill in some of the existing gaps especially in the information that had been produced by previous Finnish research. As in the case of the ninth-graders’ survey, the interview protocol was a comprehensive protocol, and hence it included items designed to elicit information that would useful for the research aims of both sub-study 1 and 2.

The interview protocol was piloted by a guidance counsellor located in Southern Finland. On the basis of the ideas gathered during the pilot interview session, and from the transcription of the pilot data and the feedback obtained from the test subject, it was decided to conduct the final interviews in the form of semi-structured interviews (Galletta, 2013) so that the interviewer could change the order of the questions and ask additional questions to address all of the intended topics. The pilot interview took approximately an hour to complete, which was considered reasonable. The author of this dissertation conducted the actual interviews as phone interviews with seven school guidance counsellors in the Eastern Finland region. The interviews were recorded and then transcribed in preparation for data analysis.

### 4.3.2 Sample

A total of 24 school guidance counsellors in the Eastern Finland region were contacted and asked if they could conduct the survey with their ninth-graders. These guidance counsellors were members of a collaboration network based at the LUMA Centre at the University of Eastern Finland. When the school guidance counsellors were contacted, they were also asked to participate in the interviews. Eight guidance
counsellors from different schools agreed to conduct the survey in their own classes, and seven of them were also willing to participate in the interview.

In all, 348 pupils (157 male, 191 female) at eight schools in the Eastern Finland region completed the survey. A trap question was included in the survey to ensure that the respondent had properly read the items rather than simply clicking through them randomly. On the basis of erroneous responses to the trap question, 246 pupils (96 male, 150 female) were eventually included in the analysis.

4.3.3 Data analysis

In both sub-study 1 and 2, the Mann-Whitney U test and Pearson’s chi-squared test (Davis, 2013) were applied to ninth-graders’ survey data. The Mann-Whitney U test was applied to the quantitative survey data in order to determine the differences between the views of boys and girls in Likert scale survey questions in sub-studies 1 and 2. As the Mann-Whitney U test tests for differences between two groups on a single, ordinal variable with no specific distribution (Mann & Whitney, 1947), it was considered a suitable method for inspecting the Likert scale survey data. Pearson’s chi-squared test (Davis, 2013) was, in turn, applied when inspecting gender differences in pupils’ responses to the open-ended inquiries. Pearson’s chi-squared test is appropriate when differences between in frequencies are inspected, and thus it was considered suitable for inspecting the differences in the frequency of the occasions on which girls and boys mentioned different people such as parents, teachers and friends, when they were asked to identify the individuals whose education- and career-related advice they listened to the most.

In sub-study 2, pupils’ justifications for their statements were examined qualitatively by adapting and dividing their justifications into categories depending on the gender-stereotypical dimensions that were observed in them. The categorization was based on the dimensions proposed by Cejka & Eagly (1999). The author of this dissertation undertook the categorization, and unclear justifications were discussed with two other researchers in the group in order to establish a consensus about the best category. During the analysis process it was discovered that, in addition to the dimensions of physical attributes, there were also the personality attributes and qualities of cognition present in the data. Hence, we decided that two additional categories – gender-typical interests, and other factors – were required.

With regard to the guidance counsellors’ interview data, content analysis (Mayring, 2000) was used as a suitable method for examining the differences and similarities between the guidance counsellors’ views and experiences. The author of this dissertation started the analysis by defining the categories in terms of inductive category development. For each of the interview questions the principal categories for the guidance counsellors’ responses were defined by reviewing all of the responses and locating the similarities and differences in their views. This inductive
category development was performed by two researchers working separately. Any disagreements between the researchers’ category developments and classifications of the interview responses were subsequently discussed and their differences resolved. In a final stage, the guidance counsellors’ views were compared with those of the ninth-graders that appeared in the survey responses.

### 4.4 METHODOLOGY AND SAMPLE IN SUB-STUDY 3

In this section detail is given of the methodological approach used in the collection and analysis of data in sub-study 3 and a description is provided of the sample used in the study.

#### 4.4.1 Data collection methods

Two interrelated areas were explored in this sub-study: firstly, the ideas expressed by the parents of Finnish adolescent children concerning the role played by gender in education and career choices; and secondly, the parent-child discussions about these ideas, especially with regard to STEM-career pathways.

To gather data from the parents, a survey instrument (Trochim, 2006) was designed and implemented to elicit the ideas held by the parents about the various aspects listed in our research aims. In total, ten survey questions were constructed by a team of three researchers with the aim of filling the research gap that had been discovered in previous research in the topic area, including parent-child discussions of the children’s plans for their professional futures. In this sub-study parents’ responses to five of these questions were examined because their responses were discovered to be the most pertinent as sources of information related to the research questions under study.

#### 4.4.2 Sample

The survey was administered online, after which a link to the survey was sent to 17 middle school guidance counsellors who, as in the case of sub-studies 1 and 2, were employed in the LUMA partnering school network in the Eastern Finland region. Of these guidance counsellors, nine agreed to distribute the survey to their pupils’ parents via school administration software. The guidance counsellors sent a link to the survey to all of their pupils’ parents, of whom 85 mothers and 18 fathers eventually responded to the survey. The data was collected in the spring of 2017.

The majority, some 69 per cent, of the parents who participated in the study, had a university or polytechnic university degree, and a majority of them, 39 per cent, were 40-49 years of age. A detailed description of the sample is presented in the third research article included in this dissertation.
4.4.3 Data analysis

The parents’ survey data was analysed by means of qualitative content analysis (Mayring, 2014). The analysis process started with inductive category development. Not all of the survey questions were adopted for analysis, but our focus was placed only on the five questions that were relevant to the research questions framing this sub-study. The other five questions were found unsatisfactory in terms of eliciting information based on the research questions. This kind of selection is considered permissible in the procedure of inductive category summarizing (Mayring, 2014).

First, two researchers who were experienced in qualitative content analysis defined the categories individually by systematically reviewing all of the responses to the survey questions and examining the parents’ ideas in the light of the research questions. In the case of each of the survey questions, they then defined the main categories of the parents’ responses.

Following the first round of category development, a pilot loop (Mayring, 2014) was performed, which meant that the researchers revised all of their category systems and checked to see whether there were any overlaps and to ensure that the category systems suited the research questions. Finally, an intercoder check was implemented in which the researchers examined their definitions of categories together and negotiated final versions if there were any differences in their views. It was discovered that in the case of most of the survey questions the parents’ responses fell quite clearly into yes/no/no opinion categories or scale-like categories. In the case of the question concerning occupational gender segregation and its consequences in the fields of science, mathematics and technology, eight categories were found to occur. The researchers classified as Other any of the responses that they considered to be either ambiguous or providing inadequate insight into the survey question.

The survey was conducted in Finnish and the qualitative content analysis was done using the Finnish data. For the research article, the survey items and examples of the parents’ responses were translated from Finnish into English only after the analysis had been completed so that the potential interpretations could be regarded as being as accurate as possible. The translations were made by the researchers, who have years of experience of translating different types of text from Finnish into English, and vice versa. The underlying idea with regard to the translations was to concentrate on intended meanings and readability, and the authors debated some of the potentially ambiguous cases in order to ensure the quality of the translations.

A statistical analysis was not made in this sub-study as it was entirely qualitative, but to complement the reported data the division of the parents’ responses into categories is also presented quantitatively in the research article.
5 OVERVIEW OF SUB-STUDY 1

The research presented in this dissertation began with the sub-study 1, which aimed to investigate the role played by socializers such as parents and teachers in Finnish ninth-graders’ education and career exploration and to discover the extent to which ninth-graders consider these socializers to contain occupational gender stereotypes. This chapter provides an overview of the main results of sub-study 1 and a brief discussion of the results in the light of previous research. In addition, suggestions for future research are provided.

5.1 MAIN RESULTS AND DISCUSSION

According to the expectancy-value theory of achievement-related choices, the psychological variables that guide achievement-related choices are influenced by the beliefs and behaviours of individual’s peers and important socializers, such as parents, teachers and school guidance counsellors (Eccles et al., 1982; Eccles, 1994). In this sub-study the focus was on analysing the ninth-graders’ survey responses and guidance counsellors’ interview responses in the items that investigated the role of socializers in ninth-graders’ education and career exploration and decision-making and the extent to what these socializers may hold occupational gender stereotypes. This kind of investigation is vital for the evaluation of who are the main sources of education- and career-related information and the conveyors of occupational gender stereotypes in ninth-graders’ social circles.

The results of the sub-study documented that the ninth-graders in this sample had most discussions concerning education- and career-related matters with their parents, friends, and school guidance counsellors, with parents topping this list. Nevertheless, almost one-third of the ninth-graders reported that they did not listen to anyone when making decisions related to their career pathway. The school guidance counsellors interviewed for the study suggested that, while adolescents often claim to make such choices individually, in reality parental participation in the career-choice process and the views and choices of friends seem to be particularly influential factors.

The results of sub-study 1 also revealed that education- and career-related discussions between ninth-graders and subject teachers are minimal; only a couple of ninth-graders in this sample reported discussing education- and career-related matters or heeding their math, physics, and chemistry teachers’ advice the most when making such decisions. Most of the guidance counsellors’ interview responses supported this claim, and they considered that subject teachers’ influence on adolescents’ plans for the future is minimal. Previous research has indicated that teachers with encouraging attitudes can promote students’ interest in choosing a
career in science or engineering (Buschor, Kappler, Keck, & Berweger, 2014; Dick & Rallis, 1991; Hazari, Sonnert, Sadler, & Shanahan, 2010). Dick and Rallis (1991) argue that teachers may play a particularly important role in influencing the career choices of female students orientating towards science or engineering. The results of this sub-study suggest, however, that explicit career conversations may happen rarely as a part of middle school STEM lessons or a teacher-student interaction outside lessons.

More investigations should be performed of the current state of STEM teachers’ career information and their readiness to integrate career information into their lessons. For example, the study by Sherman-Morris, Brown, Dyer, McNeal, and Rodgers (2013) investigating teachers’ information about geoscience and biology careers suggests that if teachers have less information about these careers, they may have difficulty in incorporating examples of those careers in their classes.

The guidance counsellors suggested in this sub-study that adolescents’ parents were the main source of occupational gender stereotypes. This claim supports the hypothesis that parents’ beliefs and stereotypes have the greatest influence on their children’s gender-role socialization (e.g. Eccles, Frome, Yoon, Freedman-Doan, & Jacobs, 2000). On the other hand, most of the ninth-graders themselves were unable to say whether their parents held views about occupations that were gender-stereotyped. Their survey responses indicated that they might not have been aware of their parents’ views, perhaps because they had had relatively few discussions with their parents in which gender issues would have intersected with career planning. Nevertheless, statistical analysis of the pupils’ responses revealed that girls noticed their parents’ segregation-orientated views more than boys did. Those few pupils who talked more in the survey comment box about their experiences of their parents’ occupational gender stereotypes mentioned that their fathers had sometimes suggested that women could not handle men’s work or that women were not strong enough to work in certain male-dominated jobs. In previously published research literature adolescents report a diversity of messages conveyed by their parents, ranging from encouragement to adopt stereotypical gender roles to the promotion of breaking down traditional norms (Martin 1996; Phillips 2000; Pollack 1998). Parents’ stereotypical ideas often convey in subtle messages (Epstein & Ward 2011; Gelman, Taylor, & Nguyen, 2004), and hence it might have been difficult for the ninth-graders in this study to report about their parents’ occupational gender stereotypes.

The ninth-graders perceived that their friends held gender-based stereotypes regarding certain jobs more than any other group of socializers. Both the ninth graders’ survey responses and the guidance counsellors’ interview responses indicated that gender-stereotypical perceptions of occupations are clearly present in conversations in friend groups, and that pupils pursuing vocational education after compulsory education seem to be particularly exposed to their friends’ gender-stereotypical views. Previous research conducted over several decades has established the distinct role played by peer groups in gender role socialization (Eisenhart & Holland, 1983; Wang & Degol, 2013). Gender stereotypes that thrive
within peer groups is concerning because it is common that if peers reinforce traditional gender role behaviour and values, girls and boys will probably engage in different activities (Eccles, 1994).

The results of this sub-study suggest that Finnish adolescents’ traditional career trajectories may result partially from having engaged in many discussions concerning these matters with parents and friends, who are most likely to hold gender-based stereotypical perceptions of occupations and may not have up-to-date information about STEM career opportunities (e.g. Archer & Dewitt, 2015). The findings of this sub-study, along with the previous research into socializers’ influence on academic and vocational aspirations confirm that, when promoting adolescents’ interests and aspirations in STEM and the mitigation of occupational gender stereotypes, it is not enough that campaigns and educational interventions only target adolescents themselves; thought should also be given to the ways in which socializers could be deployed as conveyors of STEM career information and of critical ideas related to gender stereotypes.

As parents are evidently the most important discussion partners vis-à-vis education and career matters, they should be supported by promoting their discussions of the value of STEM courses and STEM career possibilities with their children so as to help in developing and supporting adolescents’ interest and aspirations in these fields. As discussed earlier in this dissertation, the findings of Harackiewicz et al. (2012) provide empirical support for the claim that by increasing their parents’ perceived utility-value, STEM adolescents’ perceived utility-value and achievement behaviour in relation to STEM can also be increased. In addition to helping to recognize the utility-value of STEM and the job opportunities it provides, parents should be encouraged to talk with their children about the general effect of gender when discussing matters related to educational and career choices. Recognising traditional gender expectations and stereotypes related to skills and abilities will help adolescents to question widely-held beliefs that may be limiting their academic and vocational decision-making. Educational practitioners such as school guidance counsellors and teachers should be recommended to pay attention to providing parents with appropriate and easily accessible tools which they and their children could use to discuss critically the gender-stereotyped perceptions of occupations that may occur in their family, in their children’s social groups, or in the media.

Based on the findings of this sub-study and also on previous research into peer influence on the formation of gender role schemata and career choice, it is justifiable to claim that, along with parents, peers represent a crucial target group in the struggle to mitigate gender segregation. As far as previous research is concerned, the study done by Stake (2006) shows that the encouragement expressed by a child’s peers of the importance of achievement in the sciences was clearly related to more positive attitudes towards science amongst adolescents. Leaper, Farkas and Brown’s (2012) findings suggest that the support received from peers has a positive influence
on teenage girls’ motivation to pursue a career in science and mathematics. It would undoubtedly be worthwhile to harness peer influence in cultivating female students’ motivation to study STEM and also to pursue careers in STEM. Hence, future research should focus on developing educational interventions that stimulate friendship-group discussions not only about the value of STEM courses and STEM career opportunities but also about occupational gender stereotypes and gender-biased beliefs related to science and maths and other related subject areas.

6 OVERVIEW OF SUB-STUDY 2

Sub-study 2 was designed with the aim of investigating the nature of the gender-related perceptions of occupations that Finnish ninth-graders hold, according to both themselves and their school guidance counsellors. Part of this investigation was to discover if STEM occupations actually feature in these gender-related perceptions. In consequence, this chapter plans to provide an overview of the main results of this second sub-study and then also a brief discussion of its findings in the light of previous research. Suggestions for future research will also be presented.

6.1 MAIN RESULTS AND DISCUSSION

According to the expectancy-value theory of achievement-related choices, gender role stereotypes and occupational stereotypes are part of cultural milieux and their influence on individuals’ goals and general self-schemata mediates especially via individuals’ perceptions of gender roles, and activity stereotypes and task demands. In this sub-study the focus has been placed on analysing ninth-graders’ survey responses and guidance counsellors’ interview responses in the items that targeted adolescents’ perceptions of the apparent gender-appropriateness of occupations. Special attention was placed in this study on discovering whether ninth-graders held gender-stereotypical perceptions of STEM occupations. Investigating these kinds of perceptions is vital since previous research provides evidence that the association of gender-stereotypical characteristics with occupations explains individuals’ lack of interest in jobs that do not match their gender identity (Forsman & Barth, 2017). This, in turn, may well suggest occupational gender stereotypes are one of the reasons underlying female underrepresentation in the STEM fields (Wang & Degol, 2017).

The results of this sub-study suggest that the traditional stereotypes of women as being more selfless, caring and concerned about others than men (Eagly & Steffen, 1984; Kite, Deaux, & Haines, 2008) are still thriving to some extent amongst adolescents in Finland. The ninth-graders in this sample tended to suggest that especially beauty-, healthcare- and childcare-related occupations were more suitable
for women than for men and justified their views by stating that women were more interested, competent or simply more suitable for these occupations. In Cejka & Eagly’s (1999) study, college students clearly associated success in female-dominated occupations with stereotypical female personality attributes, such as being gentle, nurturing and helpful to others. These kinds of attributes may also have underlain the justifications of the sample of ninth-graders in the present study.

In turn, the ninth-graders referred to attributes such as physically strength and courage in the context of jobs suitable for men. They also thought of jobs such as construction labourer, firefighter, lorry driver and police officer as more suitable for men than for women since these jobs required physical strength which, in most cases, men possess more than women do. However, in Cejka and Eagly’s (1999) study, students rated male physical attributes as only slightly important but masculine cognitive attributes, such as being good at problem-solving and good with reasoning, as most important for success in male-dominated occupations, even though the male-dominant occupations included jobs such as lorry driver and construction labourer.

In the present sub-study, however, no masculine cognitive attributes occurred in the ninth-graders’ survey responses.

The school guidance counsellors who were interviewed had noticed that their pupils held gender-stereotypical views of occupations. The occupations that guidance counsellors reported their pupils to be considering were generally linked to a particular gender, and they were similar to those that appeared in the ninth-graders’ survey responses. In other words, they referred to occupations in the female-dominated fields of healthcare and beauty and to occupations in the male-dominated construction branch and firefighting. According to the guidance counsellors, adolescents sometimes rule out whole fields, if the occupations in the field are dominated by the opposite gender. This typically happens, for example, in the case of boys and the beauty industry.

This sub-study also documented the fact that the ninth-grade boys’ views regarding the perceived gender-appropriateness of occupations were stronger than those of the girls. The boys also thought that their gender affected their own occupational preferences more strongly than it did for the girls. The views of one of the guidance counsellors’ were clearly in line with the survey responses, since he/she reported observations of male pupils holding more segregation-orientated perceptions than did female pupils. These findings agree with previous research suggesting that men tend to more tightly maintain gender stereotypes than women do (Barth et al. 2015; Francis, 2002; Dasgupta and Asgari 2004; Miller & Budd, 1999; Miller & Hayward, 2006).

It was surprising that the ninth-graders in the present sample did not express any perceptions in the survey of the gender-appropriateness of STEM occupations even though the belief that men are more talented in mathematics and science than women has been a long-standing cultural stereotype in Western societies (Correll, 2001; Nosek et al., 2009; Steele, 1997). Neither the girls nor the boys claimed that any STEM
occupation was more suitable for a particular gender. Nor did any of them express any stereotypical masculine cognitive attributes (Cejka & Eagly, 1999), such as being mathematical or good with numbers or good at problem-solving, notions that are traditionally associated with competence in STEM jobs. In addition, there were no views related to gender differences in interest shown in the fields of science, mathematics, technology or engineering. These results may indicate that gender stereotypes related to STEM occupations are not as strong among ninth-graders as the stereotypes concerning the more traditional occupations such as nurse, construction labourer, and lorry driver. On the other hand, it is also plausible that STEM occupations were relatively unfamiliar to this sample of ninth-graders and hence they were unable to express their perceptions of them in the context of the present survey questions that did not explicitly enquire about gender-related perceptions related to STEM jobs or skills.

The results of this sub-study raise a question about whether stereotypes regarding cognitive attributes occur more frequently amongst upper secondary school students than ninth-grade pupils. Beliefs concerning science and mathematics skills may become more evident at secondary level, which is the stage at which course selections are made that will cause students to acknowledge the various factors influencing their opportunities to gain a study place in higher education or a particular job that they aspire to. Future research in this area should investigate the extent to which the influence of gender stereotypes related to competence in different domains impacts on secondary-level students’ course selection and their other educational choices.

The results of this sub-study cause concern about the state of STEM career information amongst adolescents. The underlying reason for the total lack of STEM-related views in this study may be the fact that STEM jobs do not appear to be as familiar to adolescents in everyday life as the more traditional occupations, such as teachers, salespersons, police officers or nurses. On the other hand, it may be a positive signal that no stereotypes occurred regarding a putative male superiority in math, science and technology. Earlier research into students’ perceptions of scientists have shown that students do not have a clear perception of what science has to offer them or what scientists do (Wyss, Heulskamp, & Siebert, 2012). Similar evidence has also been presented about ICT jobs (Technology Industries of Finland, 2011) and about the work done by mathematicians (Picker & Berry, 2000). In terms of future research in this area, interesting information might be acquired by exploring school students’ awareness of STEM occupations and the skills and attributes that STEM occupations nowadays require. Their ideas might then be compared with actual job descriptions contributed by STEM professionals. In addition, there should be further research into the impact of insufficient career information or false perceptions of occupations on especially girls’ attainment of STEM careers.

Sub-study 2 provides further support for the claim that was made in the earlier discussion of sub-study 1, especially with regard to the observation that more attention should be paid to the current state of middle school subject teachers’ career
knowledge and their readiness to incorporate it into their teaching. Even though the role of schools in preparing young for working life is often emphasized, previous research sheds only limited insight into the extent and practices of actual career-related activities that subject teachers are currently embedding into their teaching and of the extent to which they are effective in increasing pupils’ career awareness and in fighting occupational gender stereotypes. The results of sub-study 1 revealed that education- and career-related discussions between ninth-graders and their subject teachers are minimal. In support of mitigating occupational gender stereotypes and of supporting pupils’ interest in STEM, it is suggested that subject teachers should be better supported in introducing different types of professional role models that would help in their providing up-to-date career advice to their pupils.

7 OVERVIEW OF SUB-STUDY 3

The final part of the research process presented in this dissertation is sub-study 3, which concentrated on one socializer group — parents — and their ideas about the role played by gender in education and career choices and in parent-child discussions about such ideas, especially with regard to STEM-career pathways. The following section provides an overview of the main findings of this sub-study. In addition, space is given for a discussion of possible future research into the role played by parents in adolescents’ education and career exploration.

7.1 MAIN RESULTS AND DISCUSSION

The focus in this third sub-study was placed on the examination of two interrelated areas: firstly, the ideas expressed by middle school pupil’s parents about the role of gender in education and career choices, and secondly, on parent-child discussions about such ideas, especially with regard to STEM-career pathways. 

At the beginning of the survey addressed to parents in this sub-study, the participants were asked whether they thought their adolescent children’s gender affected any of the discussions that they had had related to their future education and careers; in other words, whether they discussed the various career opportunities in different ways depending on the gender of their child. Parents’ responses revealed that a majority of them considered that the child’s gender had no bearing on the discussions. There were eleven mothers, however, who considered that gender had had an impact on their discussions. Many of them justified their views by reporting that their children had gender-typical career interests and aspirations and that is why the discussions at home also focused mainly on these gender-typical options. One
mother said that her son has clearly expressed the thought that he was not interested in jobs in health care. Views of this kind suggest that if adolescents already have quite clear interests and aspirations, these may restrain their discussions with their parents. The converse may also be true with respect to other career pathway alternatives that may be challenging, especially if adolescents hold strong attitudes and stereotypes regarding jobs dominated by the opposite gender. One mother who was unsure about the impact of gender thought that gender segregation in society might infiltrate into their education- and career-related discussions. This was a good example of that because parental gender socialization process is often so subtle (Epstein & Ward 2011; Gelman et al., 2004) that parents may be unable to accurately self-report on the role that gender plays in their socialization practices. Explicit inquiries on the topic may hold an opportunity to help parents to think about the impact of their children’s gender on their own behaviour more consciously.

In this third sub-study, the parents were also asked if they had consciously discussed the influence of gender in making choices for their children’s future education or in choosing a career with them. They were asked to focus on the impact that they thought gender has had on education and career choices. A majority of the mothers reported having discussions with their children about the influence of gender on educational and career choices. Mothers pointed out that they had talked about the particular challenges that girls might face if they orientated towards a male-dominant field. The mothers also suggested that they had had conversations regarding the physical requirements of certain occupations, women’s conditions in working life, and the gender pay gap. Each of the fathers that reported having these kinds of discussions with their children reported that that they had emphasized to their children that gender should not have an influence on career choice. Previous studies provide support for the existence of parental gender socialization in direct communications (Martin 1996; Phillips; 2000; Pollack 1998). In such studies adolescents have reported a diversity of messages conveyed by their parents, ranging from encouragement to adopt stereotypical gender roles to promoting the breaking down of traditional norms. Direct gender communications in general, seem to be prominent in shaping young people’s perspectives (Martin 1996; Phillips 2000; Pollack 1998). It can be claimed that there exists an opportunity in direct gender communications between parents and their children to convey messages that encourage adolescents to question traditional gender roles and to promote gender-conscious education and career exploration. More attention should, however, be paid to activating parent-child communications on this topic, since in this sub-study, for example, a majority of the fathers and a third of the mothers reported that they had not brought up the gender aspect in their discussions with their children.

Approximately half of both the mothers and the fathers who participated in this sub-study had discussed educational pathways and career opportunities in the fields of science, mathematics and technology with their children, even though the mothers evaluated their own familiarity with these careers lower than did the fathers. Many
of the parents who evaluated their awareness of potential career as good also reported having themselves gained academic or working life experience in those fields. The parents who reported having only a moderate level of knowledge related to the potential career in such fields either reported being familiar with only the commonplace educational pathways or they referred to the academic background or occupation of one or more of their family members. Some parents stated bluntly that they do not know much about STEM jobs and thus could not discuss them with their children. Previous research (e.g. Archer et al., 2012) suggests that families in which the parents have an academic and/or professional background in science-related fields often have a ”pro-science” habitus (meaning that science is visibly respected in the family’s everyday practices, values and sense of identity) and have more science-specific capital (referring to science-related knowledge, attitudes, experiences and resources) with which to support their children’s science aspirations. The parents’ survey responses in this sub-study suggest that their main sources of information about STEM education- and career- opportunities are the parents’ own academic and working-life backgrounds or those of their spouse, relatives or other individuals close to them. In this context, none of the parents mentioned the teachers, school guidance counsellors or any of the Finnish organizations that are focused on providing career information to schools and to citizens in general. Such findings raise questions about the equality of Finnish adolescents with respect to the extent of the STEM-related career information and support they receive within their family context.

A few other studies that have also pointed out that parents may often lack sufficient information and support to motivate their children towards STEM careers (Hall et al., 2011; Ing, 2014; OECD 2008). Especially within families with a lower socio-economic status, science is often less familiar and visible in parents’ and children’s everyday lives (Archer et al. 2012). Such families tend not to possess the same quantity and quality of resources to provide an equivalent basis for supporting the development of children’s science aspirations (Archer et al. 2012). In promoting parental science career awareness, it could be fruitful to include parental participation in classes and school activities related to career education. Career education started to receive a greater emphasis in Finland in 2014 when Finnish basic education implemented a revised national core curriculum in which entrepreneurship and skills for working life are two of the targets set for transversal competences (Finnish National Board of Education [FNBE], 2014, p. 24-25). The curriculum now also focuses specifically on physics and chemistry with a view to increasing pupils’ awareness of careers that require skills in these subjects (FNBE, 2014, p. 418, p. 424). Collaboration and interaction between STEM subject teachers and children’s homes would be beneficial in this context since it holds an opportunity for simultaneously increasing parental familiarity with STEM career pathways and harnessing parental influence on educational and career choices for the benefit of adolescents’ STEM career planning.
Sub-study 3 suggests that parents may not be very aware of the consequences of occupational gender segregation or they do not consider segregation to be a problematic phenomenon. Mothers seemed to be able to mention more consequences resulting from occupational gender segregation than could the fathers. Every fourth mother mentioned the gender pay gap and every eighth mother mentioned the innovations or competitiveness of the Finnish nation. One mother also raised the problem resulting from cultural perceptions of what is appropriate for boys. As addressed earlier in this dissertation, occupational gender segregation has several individual and societal consequences globally such as wage inequality and labour and skill shortages. Parents’ may, however, not be aware of the multifaceted implications of gendered career choices and shortage of young people orientating towards STEM. Up-to-date information on the characteristics of the labour markets, for example the wages and employment rates in different occupations, is essential for both parents and their adolescent children in promoting conscious educational and career choices. As in the case of promoting STEM career information, collaboration between homes, school guidance counsellors, and relevant organizations operating within the economy, working life and entrepreneurship, could also be a potential way of promoting families’ awareness of the consequences of occupational gender segregation.

Considering how big of an impact middle school and upper secondary school course selections have in terms of further education and career, it would be important in the earliest stages of their children’s education for both the educators and parents to take gender segregation issues into account. Since about 2010, advanced mathematics grades have been increasingly emphasized in Finland in the application criteria not only of the STEM fields but also of other fields in terms of student selections. When a students is applying for one or more of the STEM field subjects, skills in mathematics are now also measured in the entrance examinations. If an individual is disengaged from mathematics and does not select advanced mathematics courses in the upper secondary school, it makes orientation towards higher-level STEM education more challenging. Making parents aware of this fact early enough is essential while they still have a significant influence on supporting girls into STEM pathways in particular, since they may have a lower math self-efficacy but great math abilities. Especially parents with a lower educational background should be targeted, since parents who enjoy a higher educational background appear to be more aware of the importance of early intervention and are more likely to place their children in STEM pre-schools and provide their children with extracurricular STEM activities.

Lastly, no statistical analysis was performed on the survey data in this sub-study, but mothers, rather than fathers, reported having discussions with their children about the influence of gender on educational and career choices, and it was mothers who were also better able to describe more of the consequences of occupational segregation. Little research exists into the differences between mothers’ and fathers’
views of occupational gender segregation. Several earlier studies suggest, however, that fathers hold more traditional attitudes about gender than do mothers (Blakemore & Hill, 2008; Tenenbaum & Leaper, 2002) and are rather more likely to encourage their children to practise gender-stereotyped activities (Lytton & Romney, 1991). On the other hand, a study by Frome & Eccles (1998) suggests that mothers are more influential than fathers in the extent to which girls develop gender-stereotypical views of their academic abilities. A study by Borrell-Porta, Costa-Font, & Philipp (2018) suggests that fathers are less likely to hold traditional views about gender roles if they raise a girl. Future research should delve more into the role played by mothers and fathers in adolescents’ future planning, especially in the case of girls orientating towards stereotypically masculine fields.

8 REFLECTIONS

The research aims in this project were pursued with the aid of three sub-aims that were designed to investigate the impact of socio-cultural factors on Finnish adolescents’ education and career exploration, particularly from the perspective of the fields of science, technology, engineering and mathematics (STEM). In this final section the findings of the research aims are discussed in the light of previous research in the field. This section also provides an evaluation of the legitimation, trustworthiness, and validity of the study. The limitations of the study are then also taken into consideration, and the dissertation is concluded with a brief overview of the perceived relevance of the study and some future prospects.

8.1 ACHIEVEMENT OF RESEARCH AIMS

The research problem that guided this study was that relatively little research has been carried out in Finland covering the factors underlying Finnish young people’s traditional career choices. Published studies of adolescents’ perceptions of the gender-appropriateness of occupations were especially marginal. This study aimed to produce new knowledge on the impact of socio-cultural factors on Finnish adolescents’ education and career exploration, particularly from the perspective of the various fields of STEM. The influence of socializers was investigated in sub-study 1 by examining the role played by various close individuals involved in ninth-graders’ education and career exploration and decision-making. The cultural aspect was emphasized in sub-study 2, taking the form of an investigation of Finnish ninth-graders’ perceptions of the relative gender-appropriateness of a variety of occupations. In addition, close attention was paid to the ways in which cultural gender stereotypes of STEM occupations potentially had an influence on the young people’s perceptions. Sub-study 3 concentrated on one socializer group – parents –
and their ideas about the role played by gender in education and career choices and also in parent-child discussions about such ideas, especially with regard to STEM career pathways.

It can be claimed that sub-study 1 sheds light on the current influence of socializers in Finnish ninth-graders’ education- and career-exploration in many different ways. The results of this sub-study enable us to identify the specific rank of the groups of individuals closely involved in the choices made, especially with regard to their significance as conversation partners and influencers in the ongoing decision-making, with parents topping this rank and friends and school guidance counsellors appearing somewhat lower on the scale. This finding agrees with the earlier research reviewed in the theoretical framework of this dissertation. It establishes the profound role played by parents in their children’s career planning. The findings of this study suggest that ninth-graders do not feel any real pressure from their parents to orientate towards the same careers as those of their parents.

Sub-study 1 was successful also in terms of obtaining up-to-date information about role played by subject teachers in ninth-graders education and career exploration. Both ninth-graders and their school guidance counsellors perceived the role of subject teachers as being currently marginal. Only a few ninth-graders reported having discussions about their future education and career with their physics, mathematics, and chemistry teachers. Little previous research exists that focuses explicitly on the role of teachers as career educators, especially in Finland. Several international studies, however, suggest that teacher support plays an important role in the choices made by students who have orientated towards STEM career pathways (Buschor, Kappler, Keck, & Berweger 2014; Dick and Rallis, 1991).

The present study sheds light on ninth-graders’ experiences of the extent to which they have noticed occupational gender stereotypes cropping up in their education- and career-related discussions with their socializers and also the ways in which the socializers have expressed views of this kind. In the present study, ninth-graders perceived that their teachers and school guidance counsellors seldom expressed gender-stereotypical ideas about occupations, and certainly to a lesser extent than did their parents. There exist studies from recent years, however, that have documented teachers often holding gender-stereotyped beliefs regarding their students’ abilities (Gunderson et al., 2012). The findings of this present study suggest that teachers in Eastern Finland may be relatively gender-conscious and avoid expressing stereotypical ideas in their lessons. To obtain fuller information about Finnish teachers’ gender-stereotyped beliefs and attitudes, student interviews would be a valuable way to explore their experiences in greater detail and to discover whether teacher support in the area of the study of STEM subjects differs depending on the individual student’s gender.

When attention is paid to ninth-graders’ attitudes to the gender-appropriateness of occupations, the findings presented in sub-study 2 illustrate the extent to which the ninth-graders considered that some occupations were more appropriate for men.
or for women. The findings also suggest the range of ideas on which they based their perceptions. It was found that Finnish ninth-graders’ perceptions of the suitability of certain occupations are clearly gender-stereotyped. This finding may partially explain why young people in Finland still tend to make such gendered academic and vocational choices. Occupational gender stereotypes still appear to persist in adolescents’ career planning in other countries, too, and they continue to influence young students’ preferences for educational and vocational options in ways that have traditionally been accepted as appropriate to one gender or the other (Ramaci, et al., 2017; Wang, 2017).

The aims were not approached in the most effective way in this sub-study in terms of obtaining information about ninth-graders’ perceptions of STEM occupations. The survey questions were formulated in such a way that pupils were not directly asked about their ideas concerning STEM jobs. The intention of the questions was, rather, to discover whether STEM-related gender-stereotypes occurred in pupils’ responses when more general questions were posed about their perceptions of the gender-appropriateness of a wide range of occupations.

In terms of the actual fulfilment of the research aims in sub-study 3, new information was obtained concerning parental ideas about the role played by gender in education and career choices, and parental awareness both of the consequences of occupational segregation and of STEM career pathways. Parental influence vis-à-vis gender role socialization typically occurs in more subtle forms, rather than explicit conversations. However, it was considered important to investigate parents’ subjective self-reports in this context since it represents an opportunity to reveal disagreements between previous research findings and parents’ own ideas regarding these aspects. This, in turn, provided valuable information about the need for interventions particularly targeting parents, with the prospect of their becoming more conscious about the consequences of occupational gender segregation and possibly also less euphemistic about their own role in their children’s gender socialization.

It may, therefore, be claimed that the principal aim of this research project has been properly fulfilled by means of the sub-studies discussed above. Both social and cultural elements have been integrated into the investigations related to adolescents’ education and career exploration, and up-to-date information has been gathered about the factors that underlie gendered career trajectories, especially in the various fields of STEM. Such information is insightful for researchers, educational practitioners, parents, and stakeholders in the STEM labour market in their continuous endeavour to develop young people’s interests in the direction of studying STEM subjects and aspiring to find a job in these fields.
8.2 LEGITIMATION

In this section the legitimation of the present study is scrutinized by evaluating the performance of a mixed methods research approach (Onwuegbuzie & Johnson, 2006). The following legitimation criteria will be evaluated: inside-outside legitimation, weakness minimization, conversion legitimation, commensurability, and multiple validities legitimation.

Inside-outside legitimation refers to how accurately the researcher presents and how appropriately makes use of the participants’ insider view and the observer’s outsider view for description and explanation (Onwuegbuzie & Johnson, 2006). Basically, this refers to the extent to which the researcher has succeeded in maintaining objectivity in the interpretation of data. In the present study, objectivity has been promoted by providing fully informed descriptions and explanations of the choice of particular methods of data presentation and of how the data has been analysed in each sub-study in order to enable the reader to assess the objectivity of the interpretations made from the data. In addition, the objectivity of the data interpretation has been thoroughly evaluated in the peer review process that articles 1 and 2 have undergone and that article 3 is currently undergoing.

Weakness minimization legitimation refers to the extent to which the weakness of one approach is compensated for by the strengths of the other approach or approaches. (Onwuegbuzie & Johnson, 2006). In the case of the present study, qualitative and quantitative approaches have been adopted in for each of sub-studies 1-3, with the intention of establishing a variety of data collection methods and multiple data sources, which in turn should complement each other. For example, in the ninth-graders survey boxes were included for justifications together with Likert scale questions that were intended for the collection of both qualitative data and quantitative data, thus potentially facilitating fuller interpretations of the respondents’ views. In addition, the ninth graders’ survey data was complemented by qualitative interview data provided by the school guidance counsellors in order to discover whether the guidance counsellors held similar or widely differing ideas about the topics under study. In sub-study 3, quantitative analysis was not done using the parents’ survey responses, but the data analysis was purely qualitative. However, the division of the parents’ responses into particular categories was also presented in percentages in the corresponding research article so as to provide the narrative with the fullest about the ways in which the different categories were weighted.

Conversion legitimation refers to the extent to which data conversion techniques lead to interpretable data and high inference quality (Onwuegbuzie & Johnson, 2006). In the present study, data conversion has been made in the presentation of guidance counsellors’ interview data in articles 1 and 2. In these articles, ideas regarding socializers’ segregation-orientated influence on pupils and pupils’ own segregation-oriented views that commonly occurred in guidance counsellors’
interview responses were counted, and tables presenting these counts were then created to provide a quantized data presentation of the qualitative interview data. This was thought to promote the clarity of inferences drawn from the interviews themselves and also when comparing ninth-graders’ views with their guidance counsellors’ views. According to Onwuegbuzie & Johnson (2006), more meaning can be obtained by including counts of observations along with narrative descriptions. As mentioned in the previous section, data conversion was also used in sub-study 3, where the parents’ survey data was converted into a quantized presentation together with the qualitative narrative in the corresponding research article.

Commensurability legitimation refers to the means by which, through an iterative process, a third viewpoint is created from the quantitative and qualitative components of a study. This viewpoint reaches further than what is provided by either a purely qualitative or purely quantitative viewpoint (Onwuegbuzie & Johnson, 2006). In the present study, relying exclusively on one data source or one qualitative or quantitative approach would have significantly narrowed the viewpoint. Quantitative data collection facilitated statistical analysis of gender differences in the ninth-graders’ survey responses, which is essential given that the aim is to contribute to research into gender differences in education and career exploration and aspirations. In addition, quantitative data analysis facilitated a greater generalization of the results in terms of larger populations. In turn, the qualitative components of this study made it possible to probe detailed and more exhaustive interpretations of the ninth-graders’, guidance counsellors’ and parents’ views, and also to compare ninth-graders’ ideas with the “adult viewpoint”.

Finally, multiple validities legitimation refers to the extent to which the quantitative and qualitative strands have been validated separately from each other, and the whole mixed methods study has been validated so as to develop high-quality meta-inferences. According to Onwuegbuzie and Johnson (2006), this legitimation type is critical since assessing the validity of each individual strand allows for robust meta-inferences (Onwuegbuzie & Johnson, 2006.). In the case of the present study, the validity of each of the two components of the study – the qualitative and the quantitative – have been examined individually in this section by evaluating the trustworthiness of the qualitative components and the validity of the quantitative components. By explaining openly and in detail the methodology used in the data collection, data analysis, and the focus on authentic examples of the data, it becomes possible for the reader to evaluate the multiple validities. In addition, research articles 1 and 2 have undergone the process of peer review and article 3 is currently undergoing the same process, which will then support the multiple validity of the processes involved.
8.3 TRUSTWORTHINESS

Trustworthiness is a term used in the evaluation of qualitative research rather than validity, which is more often associated with quantitative research. Trustworthiness refers to the degree of confidence that can be placed in the data, interpretation and methods used and thus ensure the quality of the study (Pilot & Beck, 2014). With respect to the qualitative components of the present study, the following criteria have been used in the evaluation of the trustworthiness of these components: credibility, transferability, dependability, and confirmability (Teddlie & Tashakkori, 2009).

Credibility, according to Lincoln & Guba (1985), refers to whether or not the reconstructions of the enquirer are “credible to the constructors of the original multiple realities”. The techniques used in the evaluation credibility of this present study are triangulation techniques, peer debriefing, negative case analysis, and member checks (Teddlie & Tashakkori, 2009). Triangulation has been deployed in the form of the triangulation of multiple information sources by collecting data from ninth-graders and their school guidance counsellors. The data collection in sub-study 3, in turn, provided complementary data for one of the central aspects of the whole study – the interpretation of the influence of parents on their adolescent children’s education and career exploration.

Peer debriefing, which refers to impartial peers examining the methodology and interpretations used (Teddlie & Tashakkori, 2009), has been included in the promotion of the trustworthiness of the present study by exposing the research findings, in the course of the research project, to discussion and assessment by colleagues outside the research group in several national seminars and at one international conference. Negative case analysis, in turn, refers to the discussion of elements of the data that do not support or appear to contradict patterns or explanations that have emerged during the data analysis (Teddlie & Tashakkori, 2009). In the present study, the data analysis processes have been described in detail, and cases contradicting the main patterns that emerged from the data have been also been focused on in the research articles and included in the discussions of the results.

Referential adequacy refers to the archiving without analysis of a portion of the research data but conducting actual data analysis on the remaining data and drawing up preliminary findings from it. The archived data is later returned to and analysed as a means of testing the validity of the preliminary findings (Lincoln & Guba, 1985). This technique was not applied in the present study as the samples were relatively small and it was considered that there would be a risk of missing interesting findings if a portion of the data was put aside.

Member-checking refers to the return of the results of a study to participants for them to check for accuracy and resonance with their experiences (Teddlie & Tashakkori, 2009). This technique was not applied in the present case. Firstly, returning material to the participants would have been impossible in the cases of the
ninth-graders and their parents, since the data was gathered totally anonymously from these samples, meaning that no contact information was obtained from the participants. In the case of the ninth-graders, member-checking was also not relevant because the data was mainly quantitative and obtaining participant validation for the qualitative parts of the survey data would not have been practical. With regard to the findings extracted from the parents’ survey data and the school guidance counsellors’ interview data, it would probably have been profitable to retrieve participant validation to assess the trustworthiness of the findings. This was not performed, which can be regarded as a missed opportunity in exploring the credibility of the results.

Concerning transferability, the term refers to the transferring of inferences from a specific source context to a specific receiving context (Teddlie & Tashakkori, 2009). In the case of the present study, thick description (Teddlie & Tashakkori, 2009) has been provided, which refers to a detailed description of the cultural context within which the research project took place, and also a description of the research process and methodology. Transferability has also been evaluated in terms of the impact of the characteristics of the samples in each of the sub-studies and the transferability of the research findings gained from these samples to the contexts of other regions of Finland and also of other countries. The limitations related to the transferability of the findings of this study are discussed in more detail in section 8.2.

Dependability, in turn, refers to the extent to which the process of the inquiry is dependable, meaning the extent to which human instrument can yield consistent results (Teddlie & Tashakkori, 2009). The evaluation of dependability in this study has been promoted by describing the research process in detail and explaining how the samples have been selected. In sub-studies 2 and 3 the data was coded by two researches individually to increase the rigor of the studies. Some limitations were discovered in selecting the samples, and they are discussed in section 8.2.

Lastly, confirmability refers to the extent to which the product of the inquiry is confirmable, including whether results are grounded in data, whether inferences are logical, whether there is inquirer bias, and so forth (Teddlie & Tashakkori, 2009). In the case of the present study, the reader’s ability to evaluate its confirmability is facilitated by the provision of authentic quotations from the survey of the participants’ and from the interview responses in articles 1-3. The double-coding performed in sub-studies 2 and 3 also reduces the possible bias that might otherwise emerge from data coding performed by a single researcher. In addition, a confirmability audit has been carried out on this study, meaning that the results and interpretations of the study have been examined by external evaluators (Teddlie & Tashakkori, 2009). This criterion has been fulfilled in the form of the peer-reviewing process that articles 1 and 2 have undergone and that article 3 is currently undergoing.
8.4 VALIDITY

In this section an inspection is presented of the validity of the quantitative components of the present study. In general, validity is an indication of how sound an item of research is. The term is often associated in particular with a research approach that is quantitative in nature, while some prefer the term trustworthiness when evaluating qualitative studies. More specifically, validity applies to both the design and the methods of quantitative research. In the evaluation of the validity of the present study the following criteria have been used: statistical conclusion validity, internal validity, the validity of the data collection, and external validity (Teddle & Tashakkori, 2009)

Statistical conclusion validity refers to the degree to which the statistical procedures have been appropriate and adequate for detecting differences or relationships. In the case of the present study the Mann–Whitney U test (Davis, 2013) was applied to the quantitative survey data in order to determine differences between the views held by boys and girls in response to the Likert scale survey questions in sub-studies 1 and 2. As the Mann-Whitney U test tests for differences between two groups on a single, ordinal variable with no specific distribution (Mann & Whitney, 1947), it was considered a suitable method for inspecting the Likert scale survey data. Pearson’s chi-squared test (Davis, 2013) was, in turn, applied when inspecting gender differences in pupils’ responses to the open-ended inquiry about whose advice they listened to the most when making education- and career-related decisions. Pearson’s chi-squared test is an appropriate test for inspecting differences in frequencies, and thus it was considered suitable for inspecting differences in the frequencies with which girls’ and boys’ mentioned different people such as parents, teachers and friends, when asked whose education- and career-related advice they listened to the most.

Internal validity refers to the degree to which alternative explanations of the results obtained can be ruled out (Teddle & Tashakkori, 2009). In the present study, internal validity has been promoted by performing the statistical analysis described in the previous section, in this way providing some certainty that the gender differences in ninth-graders’ survey responses did not occur by chance.

The validity of the data collection refers to the validity of the means by which the data collection methods have measured things. This type of validity can be evaluated in the context of the present study by assessing whether the questions in the survey instrument have actually measured what it is assumed that they should measure. Since some of the ninth-graders’ survey questions were relatively straightforward, the inferences drawn from adolescents’ self-reports should be examined through a critical lens. It is possible that social desirability bias influenced pupils’ responses especially in the case when inquiring about the extent to which their gender influences their future education and career aspirations or whose advice they listen to the most when making education- and career-related decisions. It can be argued
whether it is possible to obtain accurate information by investigating self-reports. The mixed-methods research approach, however, repairs weaknesses in the data collection instruments and expands and strengthens the study’s inferences.

Finally, external validity refers to the extent to which the inferences could be applied in other contexts (Teddllie & Tashakkori, 2009). In the case of the present study it is relevant to discuss whether the findings are generalizable to larger populations both at other points of time and in other cultural contexts. The external validity of the study has been supported by the performance of a quantitative analysis of a medium-sized sample of ninth-graders, in contrast to a very small sample. The demographic properties of this sample may, however, pose a threat to the external validity of the study. The characteristics of the samples used in the study and the limitations that they imposed will be discussed in greater detail in the following section. With respect to the generalizability of the inferences across time, cultural changes and concomitantly, changes in the attitudes, beliefs and ideas of both adolescents’ and adults, may, however, influence the temporal validity (Teddllie & Tashakkori, 2009) of this study.

8.5 LIMITATIONS AND FUTURE RESEARCH

This section focuses on the characteristics of the research design, methodology and sampling that were considered to impact on the interpretation of the findings of sub-studies 1-3. An assessment is also made of the impact of each limitation in relation to the overall findings and conclusions of the present study. In addition, suggestions for improving the research design and the requirements of future research are provided here.

8.5.1 Limitations of sub-studies 1 and 2

With respect to the data gathering that was carried out for sub-studies 1 and 2, there is a chance that bias exists in the sampling since the ninth-graders’ survey data consisted only of those groups’ responses whose school guidance counsellor agreed to implement the survey in their classes. Basically, this means that the sample was a non-random sample of a population since there was no equal selection of all of the ninth-graders in a given area. On the other hand, all of the ninth-graders who participated in the study were students at largely similar middle schools located in Eastern Finland with rather homogeneous backgrounds, which mitigates any possible bias in the results, since the willingness of their school guidance counsellors to participate in the data collection would not have influenced their views about the topic under study.

On the other hand, the fact that the sample in these sub-studies consisted solely of students and school guidance counsellors in the region of Eastern Finland, may well have an impact on the transferability of the results. Hence, the results of these
sub-studies could be considered rather as a representation of the views of ninth-graders and their school guidance counsellors in Eastern Finland region than as the generality of the views of Finnish ninth-graders and their school guidance counsellors as a whole. Future research should investigate regional differences in Finnish adolescents’ perceptions of the gender-appropriateness of occupations, and investigate whether there are any differences in the career awareness or appropriate gender roles between students from smaller, rural communities and towns and those from larger towns and cities in Finland.

Sub-study 2 revealed that no stereotypes regarding putative male superiority in maths, science and technology occurred, which was rather surprising taking into account that research in recent years has suggested that stereotypes of abilities are still thriving amongst young people (Ramaci et al., 2017; Wang & Degol, 2013). This finding may have derived from the fact that the ninth-graders’ survey instrument did not include closed-ended questions regarding the gender-appropriateness of STEM occupations. It was, however, a conscious decision to omit this kind of survey items since the aim was to gather the ninth graders’ most spontaneous views when enquiring about their perceptions of the gender-appropriateness of occupations. It is an interesting finding in itself that the ninth-graders made no reference in this study to traditional gender stereotypes vis-à-vis STEM skills or occupations. The research design in this case could have been improved by including interviews with ninth-graders in order to obtain more detailed data about occupational stereotypes and especially about stereotypes related to STEM occupations. Future research could more thoroughly investigate Finnish adolescents’ perceptions and stereotypes in this area. Valuable information would be gained by exploring pupils’ awareness of STEM occupations and of the skills and attributes that STEM occupations nowadays require. Their ideas could then be compared with actual job descriptions provided by STEM professionals. Investigations concerning the impact that insufficient career information or completely false perceptions of occupations may have, in particular, on girls’ attainment of STEM careers in Finland would be a fruitful contribution to the field of study.

8.5.2 Limitations of sub-study 3

Given the limitations of the sampling in sub-study 3, biases may arise from the fact that the survey data consisted only of the views of those parents’ who responded voluntarily to the survey. This may mean that the sample consisted primarily of those parents who were more involved in their children’s education and who were more gender-progressive or held more enthusiastic attitudes regarding gender issues. The research design could have been improved by enhancing the randomization of the sampling.

With respect to the limitations of the data collection instrument, flaws concerning the survey instrument were discovered during the data analysis since the
formulation of five survey questions were found to be unsatisfactory regarding their ability to provide information about the research questions posed in this sub-study.

An additional limitation created by the data collection instrument was that the parents were directly asked about the role that gender played in career discussions with their children, since social desirability may have influenced the responses of some of the parents. That is, some parents may have responded that gender matters very little largely because they believed that this was the "correct" response. The survey questions should have been formulated in a way that would have mitigated against the chance of obtaining desirable answers. Parental socialization into gender-typed career pathways often occurs through subtle patterns of encouragement and discouragement, rather than explicit conversations about gender (e.g., Leaper, 2015) and parents may be unable to accurately self-report on the role that gender plays in their socialization practices. Experimental or observational methods (e.g., Tenenbaum & Leaper, 2003) would have been more appropriate in studying parent-child conversations.

With respect to the transferability of the results of sub-study 3, the findings of this study represent the views mainly of parents who have a higher-level academic background. Since past research suggests that parents with high academic background place a greater value on science and mathematics (Archer et al., 2012; Shin et al., 2015), the results of this sub-study may provide a more positive impression of parental awareness of both STEM job possibilities and occupational gender segregation than would a sample of parents with more diverse backgrounds. On the other hand, all of the respondents were from Eastern Finland region, which is regarded as one of the more rural areas of Finland, especially in comparison with the metropolitan area in Southern Finland. Fewer and smaller STEM-related companies and organizations operate in Eastern Finland with which parents could have become familiar. This factor may well have influenced parents’ awareness of the diversity of STEM jobs, as discussed in this study. Future research should check more thoroughly the parents’ academic background influences on their conversations about STEM careers and the influence of gender in education and career exploration with their children. Future research could also investigate the regional differences in Finland in parental awareness of both STEM occupations and the consequences of occupational gender segregation. Since a large part of the existing evidence concerning parent-child gender communication seem to be qualitative (Epstein & Ward, 2011), performing more quantitative research on this topic is recommended, in order to attain more generalizable information.

An additional limitation of sub-study 3 was that significantly more mothers than fathers responded to the survey. Hence, it may be argued that this study is a representation of the views of mothers with a higher-level academic background from the Eastern Finland region rather than of the views of Finnish parents as a whole. It must also be acknowledged that the fathers who responded in the survey
were possibly more gender progressive and more involved in their children’s education, aspects which may have, therefore, have impacted on the results.

8.6 CONCLUSIONS AND PROSPECTS

The relevance of this study arises from the findings of sub-studies 1-3 and their contribution to research into the socio-cultural influences exerted on adolescents’ gendered education and career exploration. This study provides evidence that parents play the most important role in helping ninth-graders to choose their career, and they often are the main mediators of cultural gender stereotypes, together with ninth-graders’ friends. At the same time, this study suggests that parents’ familiarity with the range of STEM career pathways may be quite limited, and some parents state outright that they do not know much about the types of STEM jobs available and thus cannot discuss them with their children. In addition, parental awareness of the consequences of occupational gender segregation appears to be rather one-sided, and many parents may lack a multifaceted understanding of the individual and societal effects of gendered career choices. In the light of the expectancy-value theory of achievement-related choices, the findings obtained in this study are alarming, since, according to the theory and previous empirical findings supporting it, socializers’ gender-stereotyped beliefs influence their behaviour, which in turn influences individuals’ goals and general self-schemata. In addition, the information that parents provide and parental valuation of studying STEM influence adolescents’ perceived achievement expectancies and their valuation of undertaking studies within these domains, and later also their academic and vocational choices (Rozek et al., 2015).

The results of the present study provide support for the idea that there is a need to gear educational initiatives towards using parents’ central role as socializers both in encouraging adolescents to challenge traditional perceptions of the gender-appropriateness of occupations – which apparently thrive in the sample of ninth-graders involved in this study – and in promoting adolescents’ interest in and appreciation of STEM. Earlier studies have indicated that action to increase parental appreciation of the value of studying STEM and parent–child communication not only promotes parents’ and adolescents’ perceptions of the usefulness of studying STEM but also increases adolescent enrolment on STEM courses (e.g. Harackiewicz et al., 2012, Rozek et al., 2015). In designing appropriate intervention strategies targeting parents, one needs to be aware of the obstacles that parents often perceive hampering their participation in school activities. In the PISA 2018 study, averaged across the nine OECD countries that distributed the questionnaire to parents, it was found that the obstacles that parents experienced were time-related and included the need to work and the inconvenience of meeting times (OECD, 2019). However, the study done by Harackiewicz et al. (2012) suggested that even a simple intervention consisting of brochures and a web-site aimed at parents to highlight the usefulness
of STEM courses enhanced both parents’ and their adolescent children’s perceptions of the value of studying science and mathematics, and increased the likelihood of adolescents’ selecting courses in these domains. In other words, it is valuable to consider a range of interventions, depending on the available resources, from low-threshold interventions to more extensive and longitudinal treatments.

Increasing dialogue between families, schools and employers about current needs in the labour markets, job opportunities within STEM and the skills that are in demand in STEM would be beneficial, since these stakeholders have their own strengths in the interaction with adolescents. As we have learned, a great deal of the education- and career-related discussion takes place in the family context. Employers, for their part, are the ones that hold the most accurate information about careers and the labour market conditions of demand and supply. Schools, in turn, have the possibility to promote collaborative activities that involve these two stakeholders and integrate their contribution by means of guidance-counselling and subject teaching. Technology Industries of Finland supports this kind of dialogue via their MyTech program which strengthens middle school and secondary school students’ phenomenon-based project learning and helps schools to organize visits to technology companies and institutions of higher education as a part of the projects. However, developing more methods and learning materials will be in demand for supporting subject teachers in this work, especially in Finland, where compulsory basic education has started to implement a revised national core curriculum focusing specifically on physics and chemistry with a view to increasing pupils’ awareness of educational pathways and occupations that require skills in these subjects (FNBE, 2014, p. 418, p. 424).

This kind of dialogue between families, schools and employers might be beneficial especially for those adolescents with no immediate family working within STEM to encourage them to keep open the option of following STEM careers. The OECD report of 2019 documents how adolescents’ career expectations have become more concentrated in fewer occupations despite the huge changes in the world of work over the past two decades. The Report also states that the narrowing of job choices is driven by young people from more disadvantaged backgrounds and by those who were weaker performers in the PISA tests (Mann et al., 2020). In developing and supporting young people’s science interests and aspirations, families’ everyday practices, values and sense of identity, and also science-related information, attitudes, experiences and resources all hold a significant power (Archer et al., 2012). It is typical that within families of a lower socio-economic status, science is often less familiar and visible in parents’ and children’s everyday lives. Such families tend not to possess the same quantity and quality of resources that would help to provide an equivalent basis for supporting the development of children’s science aspirations (Archer et al. 2012). Collaborative work between families, schools and employers possesses an opportunity to promote equality between adolescents, assuring them that there are no limits to their educational and vocational aspirations,
and making STEM careers visible and tangible for everyone. There should also be discussion of whether schools should consciously assume a more prominent role in adolescents’ career guidance in areas where parents have lower socio-economic status and are more likely to have a lower readiness to support their children in education and career exploration.

The results of the present study have revealed that education- and career-related discussions between ninth-graders and their middle school subject teachers have been marginal. Previous studies have suggested that subject teachers’ career information may be rather limited, and hence they may have difficulty in actually projecting themselves as examples of careers in their classes (Sherman-Morris et al., 2013). The current state of STEM teachers’ career information and their readiness to integrate career information into their lessons should paid greater attention. Via subject teaching, there exists a significant opportunity to promote career information about the diversity of jobs, ranging from STEM occupations to professions in the arts and humanities. According to the expectancy-value theory of achievement-related choices, different achievement-related experiences, and individual’s interpretations of them have an important role in shaping individual’s expectations of success and subjective task value. Hence, it is essential to recognize that, in addition to career information, other classroom experiences influence on adolescents’ aspirations. In the study produced by Wang (2012) students’ experiences in the maths classroom predicted their expectations and values, which, in turn, predicted the number of high school maths courses taken and career aspirations in maths. The present study did not attempt to investigate teacher discussions or encouragement, which may be considered as a suggestion for further research in the future.

The results of this study demonstrate that ninth-graders think that their friends hold gender-stereotypical ideas about occupations more than do other socializers. As we have learned, the expectancy-value theory of achievement-related choices suggests that perception of socializers’ beliefs, expectations, attitudes, and behaviors influence one’s goals and general self-schemata, and further on achievement related performance and choices. More research into peer-group influences on adolescents’ STEM-related course selection, interest and aspirations would be beneficial in Finland in investigating the gendered choices, since peer-group influence is more influential in adolescence than at any other time in life, coinciding with the point in time at which critical course and field selections are made regarding secondary education. It would be essential to investigate further how peer-group discussions could be harnessed in discussions concerning not only the value of STEM courses and STEM career opportunities but also occupational gender stereotypes and gender-biased beliefs related to abilities and occupations. It might also be valuable to direct educational effort towards helping adolescents to become more aware of peer influence on career beliefs and decisions, and support them in controlling peer pressure before it leads to undesired outcomes. Creating an environment for open communication about gender stereotypes and inviting diverse role models of STEM
professionals in the school promoting the idea that STEM is for everyone could be one practical way to encourage independence in goal-setting and promote the development of STEM identities among adolescents.

In the theoretical framework of this dissertation a brief description was presented of how the STEM fields are expanding and of the kinds of challenges that are arising globally. In education it is crucial to recognize where the focus of labour and skill demands in the STEM fields will be located in the future. It appears that environmental issues are one of the main sectors where STEM-skilled workers will be needed. In 2019 the European Commission laid out a Green Deal for the European Union and its citizens. It restates the Commission’s commitment to tackling climate and environment-related challenges. The main aims of the Green Deal are to reduce the net emissions of greenhouse gases to zero by 2050 and to decouple economic growth from resource use. These are major objectives and achieving them will demand an increasing emphasis in STEM education on sustainability and also to ensure that there are enough young people, of all genders, orientating towards professions that work with the actions that support sustainable solutions in industries and societies.

As a final conclusion, it can be claimed that this study has practical implications since it recognizes the socio-cultural factors currently influencing Finnish adolescents’ education and career exploration. The results of this study may be helpful in developing interventions that will enhance adolescents’ readiness to make well-informed education- and career-related decisions without gender-related biases, and to improve their interest in and appreciation of STEM.
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ARTICLES

ARTICLE I

ARTICLE II

ARTICLE III
ARTICLE I
The influence of parents, teachers, and friends on ninth graders’ educational and career choices

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ABSTRACT
Socializers, such as parents, teachers and friends, play an important role in gendered choices in STEM fields. This study examined Finnish ninth graders’ and their school guidance counselors’ views concerning the influence of socializers in adolescents’ educational and career exploration and decision-making. The data were gathered with the aid of online surveys (246 pupils) and semi-structured interviews (7 school guidance counselors). Our results indicate that ninth graders reported to have future education and career-related discussions mostly with their parents, friends, and school guidance counselors but only rarely with their subject teachers. According to guidance counselors, parents are the main source for occupational gender-stereotypes, and gender-typed views are clearly present in education- and career-related discussions in friend groups. The latter view is also witnessed in the responses of ninth graders. We suggest that subject teachers should play a more prominent role in career-related discussions in order to prevent and mitigate pupils’ gender stereotypes and to update their knowledge about STEM career possibilities. Parents should also be encouraged to talk about gender in career planning and should be provided with information about STEM education and occupations. Developing new methods and materials demonstrating career possibilities with regard to gender is required for STEM teaching and for parental participation in adolescents’ career planning.

KEYWORDS
STEM; gender; segregation; socializers; career choice
The influence of parents, teachers, and friends on ninth graders’ educational and career choices

INTRODUCTION

Finland is considered to be a pioneer in gender equality, but still its young people choose quite traditional careers and its level of occupational gender segregation is the fourth highest in Europe (Bettio & Verashchagina, 2009). Despite the progress in gender-equality legislation and countless programs and projects in the pursuit for de-segregation, segregation levels are high and stable, especially in the fields of science, technology, engineering and mathematics (STEM) (Statistics Finland, 2016a). Female students are already underrepresented at secondary-level vocational education in the fields of science and engineering, while in higher education they orient towards the fields of life sciences more often than the physical sciences, applied mathematics, or engineering. Science and engineering are among the principal occupations of Finnish men, while those of Finnish women are related to social work, healthcare or education (Statistics Finland, 2016a).

Labour markets in many other egalitarian welfare states in Europe and the USA have similar characteristics (National Science Foundation, 2017; Burchell, Hardy, Rubery, & Smith, 2014). Currently, the amount and type of workforce does not meet the demands of labour markets, and hence STEM fields are suffering from shortages of skills and labour (Caprile, Palmén, Sanz, & Dente, 2015, pp. 9-17). In Finland, for example, technology is the country’s largest industry and its products and services account for a half of all Finnish exports (Finnish Customs Statistics 2016; Statistics Finland 2016b). Its forestry and chemical industries are the country’s second and third largest, respectively, so a sufficient supply of STEM skilled labour is essential for maintaining and developing the well-being of its citizens. While societies all over the world rely on the development of science and technology, the dearth of female skills and labour input causes concern in these fields.

Recent international comparative assessments of student achievement, such as Trends in Mathematics and Science Study (TIMMS) and the Programme for International Student Assessment (PISA), have shown a reduction in boys’ advantages when it comes to achievements in science (Martin, Mullis, Foy, & Hooper, 2016; OECD, 2016). Gender differences in achievement in math have also been observed to be rather small cross-nationally (Else-Quest, Hyde, & Linn, 2010). Despite their good learning outcomes in science and math, recent research shows that girls still feel that they are less likely to obtain work in certain STEM areas; PISA’s 2015 report showed that 15-year-old girls who were interested in a pursuing a science career saw themselves working as healthcare professionals rather than as scientists, engineers, or ICT professionals (OECD, 2016).

The narrowing gap in gender differences in science and math achievement suggests that the causes underlying gendered choices in STEM are related to socialization and attitudes rather than to actual academic achievement. Research (e.g. Ferry, Fouad, & Smith, 2000; Gunderson, Ramirez, Levine, & Beilock, 2012; Jacobs,
Chhin, & Bleeker, 2006) has provided a vast amount of evidence to indicate that parents, teachers, friends, and other socializers contribute to the continuance of gender segregation in STEM fields by reinforcing cultural stereotypes of male superiority in science and mathematics and encouraging boys and girls to follow different career paths.

The influence of socializers is recognized in many career choice models (e.g. Gottfredson, 1981; Lent, Brown, & Hackett, 1994; Meece, Parsons, Kaczala, Goff, & Futterman, 1982; Van Esbroeck, Tibos, & Zaman, 2005). In their investigation of the influence of socializers in gendered career choices in science and engineering, Dick and Rallis (1991) adapted a model of career choice (Figure 1) based on the work of Meece et. al (1982). Their model suggests that attitudes and behaviors of socializers influence student’s self-concept and career values via students’ own perceptions of socializers and interpretations of the experiences that they provide. Both students and their socializers are part of the same cultural milieu, which shapes socializers’ attitudes and behaviors, student’s perceptions of them, and, directly, student’s self-concept and career values – the two constructs guiding a student to his or her final career choice.

**Figure 1: Model of career choice, adapted by Dick and Rallis (1991)**

Dick and Rallis’s model for career choice suggests that the differences in boys’ and girls’ self-concepts and career values result partly due to the different influences provided by socializers, who (1) have different attitudes, expectations and goals for boys and girls and (2) provide different activities and experiences for both sexes. These two aspects are examined below in more detail in light of recent research findings regarding the influence of those close to them on students’ gendered career choices in STEM.
(1) Socializers have different attitudes, expectations and goals for boys and girls
Several studies from recent years document that parents’ attitudes, expectations, and goals for their male and female children are still different with respect to their future education and career. First of all, parents’ perceptions of their children’s science and math abilities are gender-biased. Tenenbaum and Leaper’s (2003) study, for example, revealed that parents of adolescents believed that science was more difficult and less interesting for daughters than for sons, despite the lack of evidence of any gender-related differences in childrens’ achievements in science. Other studies (Bhanot & Jovanovic, 2009; Bleeker & Jacobs, 2004) have also revealed that parents of boys overestimate their child’s science and math ability more often than the parents of girls. Parents’ gender-biased beliefs of their children’s abilities have been documented to have an influence on young people’s science and math self-efficacy, and as a result of them girls commonly underestimate their skills in these fields (Bhanot & Jovanovic, 2009; Tenenbaum & Leaper, 2003). While perceived efficacy is a key determinant of children’s and adolescents’ perceived occupational self-efficacy and preferred career choice (Bandura et al., 2001), research findings suggest that retention of women in STEM fields is partly a result of the girls’ low self-efficacy in science and math due to parental influence.

Research shows that parents have gender-related expectations for their children’s occupational achievements at an early age, and that these expectations are connected to the career-related decisions made by the children (Jacobs et al., 2006). Shin et al. (2015) found that parents were more likely to expect their sons to orient towards STEM occupations than their daughters. Parents have also been found to consider science and math more important for their sons than for their daughters (Bhanot & Jovanovic, 2009). In their study, Bhanot and Jovanovic’s reported that middle-school girls valued science more when either parent believed learning science was important for their daughter. Findings like these suggest that parental career expectations and perceptions regarding the value of science and math for their children play an important role for girls when they are deciding whether or not to pursue further education and a career in STEM (Bhanot & Jovanovic, 2009).

Friend groups have also been found to hold gender-stereotypical beliefs such as male superiority in the fields of science and mathematics (Bleeker & Jacobs, 2004). It has been suggested that the peer pressure exerted by friend groups for maintaining traditional gender roles has resulted in girls experiencing more support for subjects perceived as feminine (e.g. English) than for perceived masculine subjects, such as science and mathematics (Leaper, Farkas, & Brown, 2012). On the other hand, the support of friends has been found to have a positive influence on adolescent girls’ motivation to pursue a career in science and mathematics (Stake, 2006; Leaper, Farkas, & Brown, 2012).

When it comes to the attitudes and behaviors of educators, the support of teachers appears to play an important role in pupils making non-traditional educational and occupational choices. Dick and Rallis (1991) documented that teachers were perceived to have influenced female senior high-school students’ career choices more often for those who had chosen careers in engineering and science than for
those who hadn’t chosen such careers. Buschor, Kappler, Keck, and Berweger (2014) reported similar results in their study, in which students who oriented towards a career in a non-traditional area of work reported to have received support from their teachers. On the other hand, Gunderson et al. (2012) found that teachers often hold gender-stereotyped beliefs regarding their students’ math abilities, and that these beliefs influence students’ attitudes and performance regarding math and their pursuit of math-related careers.

(2) Socializers provide different activities and experiences for boys and girls

According to Dick and Rallis’s model of career choice (Figure 1), socializers not only influence children through their attitudes and expectations but also provide experiences and influence on children’s interpretations of those experiences. For instance, parents have the final say regarding what leisure activities their offspring engage in during childhood and adolescence.

As explored in section (1), parents have different perceptions of the abilities of boys and girls. Research has found that these perceptions influence them in providing their children with activities that they believe they are interested in and able to do. Parents have been found to encourage boys to participate in science- and math-related leisure activities more than they encourage girls (Jacobs & Bleeker, 2004). While involvement in specific leisure activities shapes children’s values and self-competence regarding similar activities (Jacobs, Vernon, & Eccles, 2005), girls’ lower participation in science- and math-related activities has been suggested as being partially responsible for girls’ lower self-competence and interest in those subject areas.

From sections (1) and (2), it can be concluded that recent research findings are well in agreement with Dick and Rallis’s (1991) model of career choices (Figure 1) and give evidence that adolescents still plan their career paths within the context of socializers’ attitudes and behaviors, which largely reflect common cultural gender stereotypes. Thus, it is no wonder that adolescents’ educational and occupational choices in STEM continue to be gendered. It is important to recognize the influence of different groups of socializers while pursuing the desegregation of STEM in order to develop relevant ways for recruiting socializers to cultivate young people’s interest in science-related fields and mitigating the effect of gender stereotypes in career planning.

RESEARCH AIMS

Earlier research into the influences of socializers on children’s attitudes to STEM includes very little examination of how much adolescents discuss their future education and career plans with them. In addition, there has been little research in exploring their perceptions of occupational gender stereotypes in these discussions and how they have observed socializers to express these stereotypical views.

There is certainly limited research on teachers’ influence on their pupils’ gender-related choices in STEM. Even though the role of schools in making young people ready for working life is often emphasized, earlier research gives only limited insight into actual career-related conversations between STEM subject teachers and pupils, not to mention how much or how little they talk about gender-
appropriateness of certain occupations in these conversations. These are important factors to be aware of in order to develop new methods and materials for teachers to help them promote de-segregation and encourage girls in pursuing education in STEM-related subjects.

It is worth noting that earlier research examining the influence of socializers on adolescents’ career choices in Finland has not included ninth graders. Ninth grade is, however, the point when adolescents are finishing their compulsory education and are making educational and occupational choices for the future. Therefore, examining the views of ninth graders is crucial for tackling gendered attitudes towards STEM fields already included in compulsory basic education, because gender segregation levels are already high at upper-secondary level.

Besides ninth graders’ views, we also chose to examine the perceptions of school guidance counselors, since they play a central role in education- and career-related discussions and in offering careers advice to adolescents in a school environment (CIMO, 2009). Thus, they presumably have some insight into the role of socializers in adolescents’ gendered educational and career choices.

In this article, we investigate the type and frequency of education- and career-related conversations between different groups of socializers and adolescents, and the extent to which occupational gender stereotypes are present in these conversations. The following research questions were formulated:

1. What is the role of socializers for ninth graders’ educational and career-related choices?
2. To what extent do socializers hold occupational gender stereotypes?

Both of these research questions were evaluated from the perspectives of ninth graders and their school guidance counselors.

**METHODOLOGY**

In order to find answers to the stated research questions, a survey to examine the views of Finnish ninth graders was designed and implemented. As well as ninth graders, school guidance counselors were interviewed and their views were compared to the ninth graders’ views.

**Data Collection Methods**

In order to address ninth graders’ ideas about the role of socializers in their education and choice of career, a survey instrument (Trochim, 2006) was designed consisting of demographic questions, Likert-scale statements, and comment boxes in which pupils could justify their responses to the those statements. The aim was to gather information concerning the following themes:

1. Basic information: the respondent’s gender, home town, school and class
2. How much (or how little) each respondent discussed education- and career-related matters with the different groups of socializers
3. Whose advice the respondent listened to most when making decisions about their education and career
4. The respondent’s perceptions of their parents’ expectations of them choosing the same area of work in which their parents were working
5. The extent to which the respondent considered socializers to hold occupational gender stereotypes.

The survey was administered online, which made it easier for the guidance counselors to distribute it to their pupils and expedited the analysis process.

The survey was piloted with 73 ninth-grade pupils from one school located in southern Finland. In the pilot survey instrument, pupils were encouraged to write down their feedback of the survey, and the pupils’ guidance counselor was also asked to report their experiences concerning the pilot study. Based on the feedback from pupils and their guidance counselor, one potentially ambiguous question was consequently reformulated to correct this.

In order to explore the views and experiences of school guidance counselors regarding the role of socializers in adolescents’ education and career planning, and their gender-typed views concerning occupations, a semi-structured interview protocol (Galletta, 2013) was designed based on results of earlier research findings to form a framework for the interview questions.

With the final interview instrument, guidance counselors’ views and experiences of the following topics were explored:

1. The role and effect of parents in adolescents’ education- and career-related choices
2. The role of siblings and other relatives in adolescents’ education- and career-related choices
3. The role of friends in adolescents’ education- and career-related choices
4. The influence of socializers on adolescents’ gender-typed education- and career-related views and choices.

The interview protocol was piloted by interviewing one school guidance counselor from southern Finland. The transcription of this interview recording did not flag any reasons to modify the questions, so the same instrument was used in the final interviews. The pilot interview data was not included in the analyzed data.
Sample
Altogether, 24 school guidance counselors in eastern Finland were contacted and asked to conduct the survey with their ninth graders. Each was also invited to participate in an interview. Eight guidance counselors from separate schools agreed to conduct the survey in their lessons, and seven of them were willing to participate in the interview as well.

Overall, 348 pupils (157 male, 191 female) from eight schools in east Finland completed the survey. A trap question was included in the survey to ensure that each respondent had read the items instead of just clicking through them randomly. Due to the erroneous responses to the trap question, 246 pupils (96 male, 150 female) were eventually included in the analysis.

Data Analysis
The data produced by this study consisted of ninth graders’ survey results and guidance counselors’ interviews. The Mann–Whitney U test and Pearson’s chi-squared test were applied to the quantitative survey data in order to determine differences between the views of boys and girls (Davis, 2013). With the guidance counselors’ interview data, content analysis (Elo & Kyngäs, 2008) was used as a method of examining differences and similarities between their views and experiences. In addition, their views were compared with those of the ninth graders that mediated through the survey responses.

Because the survey and interviews were conducted in Finnish, all the analysis was conducted with the original data. Thus, the surveys items, interview questions, and examples of the guidance counselors’ interview responses and the ninth graders justifications to the Likert statements were translated from Finnish to English for this manuscript after the actual data analysis in order to keep the possible interpretations as pure as possible. The translations were conducted by the authors, who have years of experience of translating different types of text from Finnish to English and vice versa. The underlying idea for the translations was to concentrate on intended meanings and readability, and the authors debated some possibly ambiguous cases in order to ensure the quality of translations. (It should also be highlighted that Finnish uses the same term, hän, for both feminine and masculine personal pronouns, which is a rather unique linguistic characteristic.)

To enable the reader to evaluate our analyses and conclusions, examples of the guidance counselors’ interview responses and the ninth graders justifications to the Likert statements are presented in the Results section.

RESULTS

Ninth Graders’ Views
Table 1 shows the number of ninth graders who reported having a lot or quite a lot of education- and career-related discussions with the socializers given in the survey instrument. The majority (74%) of ninth-grade pupils reported having a lot or quite a lot of education- and career-related discussions with their parents. At 70%, friends were the second most important discussion partners (for girls, the proportion of discussions with parents and friends were equal), while school
guidance counselors were the third most important discussion partners (46%) for both boys and girls. The Mann–Whitney U test revealed significant differences between the responses of boys and girls in terms of the number of discussions with parents, friends and siblings. Girls reported having education- and career-related discussions with these people more than boys did. Both boys and girls reported having fewest career-related discussions with their subject teachers; only 6% reported having a lot or quite a lot of discussions regarding their future plans with math, physics and chemistry teachers and 12% with other subject teachers.

| Table 1: Number of ninth graders (N=246) who reported having a lot or quite a lot of education- and career-related discussions with the people given in the survey |
|-------------------------------------------------|----------------|-----------------|
|                                                   | Girls (N=150) | Boys (N=96)     |
| Parents                                          | 120 (80%)**   | 61 (63%)        |
| Friends                                          | 121 (81%)**   | 51 (53%)        |
| Guidance counselor                               | 68 (45%)      | 46 (48%)        |
| Siblings                                         | 59 (39%)*     | 27 (28%)        |
| Other relatives                                  | 32 (21%)      | 23 (24%)        |
| Other teachers                                   | 11 (7%)       | 9 (9%)          |
| Math, physics and chemistry teachers             | 6 (4%)        | 8 (8%)          |
| Language teachers                                | 2 (3%)        | 9 (9%)          |

Significant gender difference within the answers * p < .01, ** p < .001.

For questions that came with a comment box, the ninth graders were asked to write down whose advice they listen to the most when making decisions regarding their education and future career (see Table 2). Altogether, 45% of the ninth graders reported listening the most to their parents or either their mother or father when making these kinds of decisions, although their mother was mentioned more often (10%) than their father (2%). Twenty-eight per cent of the pupils said that they didn’t listen to anyone else when making these decisions. Guidance counselors were placed third in these rankings, at 17%, and even though ninth graders had significant numbers of education- and career-related discussions with their friends, only 8% of the pupils reported listening to their friends’ advice the most, and only 1% (three pupils) wrote that they listened to their teachers the most. Statistical
analysis using Pearson’s chi-squared test showed that for this question there were no statistically significant differences between the responses of boys and girls.

Table 2: Number of ninth graders who reported listening to various people’s advice the most when making education- and career-related decisions. (Note: Responses do not add up to 246 because some respondents reported more than one person.)

<table>
<thead>
<tr>
<th></th>
<th>Girls (N=150)</th>
<th>Boys (N=96)</th>
<th>Total (N=246)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parents</td>
<td>56 (37%)</td>
<td>24 (25%)</td>
<td>80 (33%)</td>
</tr>
<tr>
<td>No one</td>
<td>42 (28%)</td>
<td>26 (27%)</td>
<td>68 (28%)</td>
</tr>
<tr>
<td>Guidance counselor</td>
<td>28 (19%)</td>
<td>14 (15%)</td>
<td>42 (17%)</td>
</tr>
<tr>
<td>Mother</td>
<td>17 (11%)</td>
<td>7 (7%)</td>
<td>24 (10%)</td>
</tr>
<tr>
<td>Friends</td>
<td>16 (11%)</td>
<td>4 (4%)</td>
<td>20 (8%)</td>
</tr>
<tr>
<td>Don’t know/Didn’t understand the question</td>
<td>4 (3%)</td>
<td>4 (4%)</td>
<td>8 (3%)</td>
</tr>
<tr>
<td>Other relatives</td>
<td>6 (4%)</td>
<td>1 (1%)</td>
<td>7 (3%)</td>
</tr>
<tr>
<td>Father</td>
<td>2 (1%)</td>
<td>4 (4%)</td>
<td>6 (2%)</td>
</tr>
<tr>
<td>Family</td>
<td>5 (3%)</td>
<td>-</td>
<td>5 (2%)</td>
</tr>
<tr>
<td>Teachers</td>
<td>3 (2%)</td>
<td>-</td>
<td>3 (1%)</td>
</tr>
<tr>
<td>Boyfriend</td>
<td>1 (&lt;1%)</td>
<td>-</td>
<td>1 (&lt; 1%)</td>
</tr>
<tr>
<td>Career psychologist</td>
<td>1 (&lt;1%)</td>
<td>-</td>
<td>1 (&lt; 1%)</td>
</tr>
</tbody>
</table>

Table 3 shows the number of ninth graders who agreed or strongly agreed to a statement that their mother or father wanted them to choose the same area of work in which they themselves worked. Overall, 9% of the ninth graders reported that they thought their father expected this of them and 4% thought that their mother did. There were no statistically significant differences between the responses of boys and girls according to the Mann–Whitney U test.
Table 3: Number of ninth graders (N=246) who agreed to a statement that their mother or father wanted them to choose to the same area of work in which they themselves worked.

<table>
<thead>
<tr>
<th></th>
<th>Girls (N=150)</th>
<th>Boys (N=96)</th>
<th>Total (N=246)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Father</td>
<td>7 (5%)</td>
<td>14 (15%)</td>
<td>21 (9%)</td>
</tr>
<tr>
<td>Mother</td>
<td>9 (6%)</td>
<td>2 (2%)</td>
<td>11 (4%)</td>
</tr>
</tbody>
</table>

Table 4 shows the numbers of ninth graders (N=246) who agreed to statements concerning claims that different groups of socializers think that some occupations are more suitable for men and vice versa. Out of the people listed, ninth graders ranked their friends as having the most gender-stereotypical views regarding occupation; one-third of the pupils stated that their friends considered certain occupations to be more suitable to women and vice versa.

Table 4: Number of ninth graders (N=246) who agreed to a statement stating that the people listed view certain occupations as being more suitable for men while others are more suitable for women.

<table>
<thead>
<tr>
<th></th>
<th>Girls (N=150)</th>
<th>Boys (N=96)</th>
<th>Total (N=246)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friends</td>
<td>38 (25%)</td>
<td>38 (40%)</td>
<td>76 (30%)</td>
</tr>
<tr>
<td>Father</td>
<td>31 (21%)*</td>
<td>15 (16%)</td>
<td>46 (18%)</td>
</tr>
<tr>
<td>Mother</td>
<td>18 (12%)*</td>
<td>10 (11%)</td>
<td>28 (11%)</td>
</tr>
<tr>
<td>Teachers</td>
<td>25 (17%)</td>
<td>10 (10%)</td>
<td>35 (14%)</td>
</tr>
<tr>
<td>Guidance counselor</td>
<td>17 (11%)</td>
<td>17 (18%)</td>
<td>34 (14%)</td>
</tr>
</tbody>
</table>

Significant gender difference within the answers * p < .01, ** p < .001.

In the comment boxes that were placed alongside the Likert statements, a few pupils commented on how their friends held segregation-oriented views:

Boy A: "They laugh at some jobs."
Boy B: "They believe in the same old stereotypes."
Boy C: “They think jobs in the cosmetics industry aren’t suitable for men.”
Girl A: “Some of them think a woman can’t be a lumberjack, for example.”
Girl B: “Boys always have a go at us for not being able to change a car tire, etc.”

Two girls announced that gender wasn’t an issue among their friends when it came talking about careers:

Girl C: “My friends are so clever, they think gender doesn’t matter.”
Girl D: “None of my friends care whether a job’s feminine or masculine when making career plans.”

More than half of the ninth graders were unable to say whether or not their parents had views regarding the gendered segregation of jobs; when asked that question with regard to their fathers, 59% responded with “no opinion” while 53% said the same when asked about their mothers. Nevertheless, analysis on the responses using the Mann-Whitney U test revealed that girls noticed their parents’ segregation-oriented views more than boys did. Here are some examples from the girls in the sample that illustrate how gender-typed views have come up when talking to their parents:

Girl E: “My father thinks the automobile industry is for men only.”
Girl F: “My father sometimes thinks women can’t handle men’s work.”
Girl G: “My father thinks men are stronger, which is why they’re better at some jobs than women.”

Altogether, 14% of the pupils agreed that their guidance counselor held gender-typed views about certain jobs, and the same number of pupils said the same about subject teachers (see Table 4). However, none of them gave examples of how guidance counselors’ gender-stereotypes were revealed. Those pupils who disagreed with the statement commented that their guidance counselors demonstrated evidence of non-stereotypical thinking and an encouraging attitude towards the pupils. (Note: Because the Finnish language does not distinguish he and she, the gender of the guidance counselor could not be identified in ninth graders’ responses, so they are referred as he/she in the examples given below.)

Boy E: “My guidance counselor said you should choose any job you’re really interested in.”
Girl I: “My guidance counselor is open-minded. He/she thinks that men and women can do the same things.”
Girl J: "My guidance counselor encourages us to choose jobs we’re interested in rather than girls’ jobs, or something like that."

Girl K: "We’ve talked about this [gender aspect] in class, and my career counselor thinks that a man or a woman can study whatever he or she wants, even if the career field is predominantly female or male."

Three girls told of how they found out about their subject teachers’ views regarding occupational segregation:

Girl L: "One teacher has said disparaging things about women."

Girl M: "Some of my teachers are old-fashioned."

Girl N: "My physics and chemistry teacher’s [views came out] during conversations with them."

**School Guidance Counselors’ Views**

Table 5 summarizes the similarities that were found between the views of seven guidance counselors regarding the influence of socializers in adolescents’ education and in their choice of career. The crosses in the table represent which ideas occurred during interviews with each of the guidance counselors (GC1–7).
### Table 5: Guidance counselors’ views regarding the influence of socializers in adolescents’ choice of education and career

<table>
<thead>
<tr>
<th></th>
<th>GC1</th>
<th>GC2</th>
<th>GC3</th>
<th>GC4</th>
<th>GC5</th>
<th>GC6</th>
<th>GC7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socializers’ own career paths have an influence on adolescents’ career paths</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Adolescents claim that they make choices regarding education and careers individually</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Parents have the biggest influence on adolescents’ choices</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Older siblings’ experiences have an impact on adolescents’ choices</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>The influence of school guidance counseling on adolescents’ choices is minimal</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Teachers’ attitudes and behaviors are mostly encouraging/motivating</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Teachers play a minor role in pupils’ education and career selection</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Friends’ views have an impact on pupils’ choices</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Four out of the seven guidance counselors reported that adolescents often claim that they make education- and career-related decisions individually, but in reality their parents’ advice has a significant influence and adolescents feel that their participation in the decision-making process is important. Five out of seven guidance counselors considered that adolescents want their parents to participate more in their career planning.
GC1: “They often claim that [making education- and career-related choices] is just their own business. I still think they’d be happy for their parents to make the effort to come to school and discuss these things together.”

GC3: “Yes, they do [want to make choices individually]. First, they may think, ‘I’m going to choose by myself, it’s none of their business,’ … but as they talk things over [with their parents] they see that some progress related to the decision-making process occurs during these discussions.”

GC6: “Even though adolescents say they can make the decisions all by themselves, and even though they argue with their parents, their parents’ opinions come through. The role of parents is a very important part of the process … as is their interest in general.”

According to the guidance counselors, it’s rare these days for parents to pressurise their children into making certain kinds of choices. Two guidance counselors mentioned a case where a parent had been shocked by their child’s educational choice and pursued the matter with their guidance counselor.

With respect to the influence of siblings and other relatives, four guidance counselors noted that the older siblings’ experiences at school and work sometimes have an impact on adolescents’ educational choices at upper-secondary school or their choice of career. One guidance counselor also observed that grandparents sometimes serve as career role models.

The guidance counselors were asked to comment on their influence on the children’s educational- and job-related choices in general. They all said that, on average, their influence was minimal. Three of them stated that their influence was strictly secondary to that of the children’s parents.

GC5: “On a scale of one to ten, I would say that [guidance counselors’ influence] is three at most. The views of the family members play a much bigger role.”

All of the guidance counselors said that subject teachers are mostly encouraging towards their pupils and aim to motivate them with respect to their plans for the future, although five of them believed that the subject teachers’ role in the children’s choices regarding education and career was a minor one.

GC4: “I think that the influence of subject teachers is minor. It depends a lot on the subject and on the teacher. I believe that subject teachers could have a stronger influence on adolescents’ choices, but they aim to do it very seldom.”

Six out of seven guidance counselors reported that friends had an impact on adolescents’ educational and occupational choices, while three thought that friends’
views were more influential on boys than on girls. In general, it’s true that adolescents discuss their future plans with their friends a lot and often want to go to the same school with their closest friends. One guidance counselor pointed out that maturity is an important factor for pupils when it comes to their friends influencing their plans for the future.

GC4: “Friends do have an influence on them ... Also, if the student isn’t very mature yet, their peer group’s influence on their future plans is stronger compared to that of peers of the same age who are more mature.”

Table 6 summarizes the seven guidance counselors’ views regarding socializers’ influence on occupational gender stereotypes and gendered educational and occupational choices. Six of them thought that parents are the main source of gender-typed images of occupations. They also observed that perceptions of and attitudes towards occupations develop at childhood via toys, hobbies and other cultural experiences.

GC1: “Parents mediate the models of a man and a woman when children are very young ... via toys they buy for them and the way they play with them.”

GC7: “I think that parental effect strengthens the gender-typed images of occupations because many of the mothers work in healthcare and many of the fathers work with machines, etc. Even if they didn’t recommend these jobs for their children, all this mediates the roles of men and women.”
Table 6: Views of guidance counselors regarding socializers’ segregation-oriented influence on pupils

<table>
<thead>
<tr>
<th></th>
<th>GC1</th>
<th>GC2</th>
<th>GC3</th>
<th>GC4</th>
<th>GC5</th>
<th>GC6</th>
<th>GC7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parents are the main source of gender-typed images of occupations</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Parental influence in education and career choice process is segregation-oriented</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject teachers fight against gender stereotypes or their influence is neutral</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject teachers have gender-stereotyped attitudes or behaviors</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friends’ attitudes influence students to make gender-stereotypical choices</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Six out of seven guidance counselors believed that, in general, subject teachers’ attitudes and behaviors towards pupils are not very gender-biased anymore. One guidance counselor thought that male teachers handle male pupils differently compared to female pupils but did not explain further. Two counselors related cases where pupils had reported a male teacher for expressing gender-stereotyped attitudes or behaviors.

GC1: “A few girls once complained me of one of their male mathematics teacher who had said girls don’t understand certain [math-related] things... But I would say that cases like this are very rare.”

Of the six guidance counselors who reported that friends have an influence on adolescents’ educational and occupational choices, three stated that the friends’ influence resulted in gendered choices. Friends’ gender-stereotypical attitudes seem to guide particularly those pupils who are pursuing vocational education after compulsory basic education.
GC2: "You can clearly see that friend groups have an impact on adolescents’ choices, especially in pupils who pursue secondary vocational education. They [debate] with each other about which area to choose... the electrical trade or the social and healthcare sectors, for example. In my opinion, friend groups really have an influence on them.”

GC6: "There have been boys [in my counseling sessions] who have felt a bit unsure [about applying] to study to be a nurse. They worry about the views of their friends.”

One guidance counselor observed that relatives and other socializers can also help to subvert gender stereotypes. According to GC4, non-stereotypical examples can encourage adolescents to orient towards atypical career paths.

GC4: “In many cases, the role models that come from the pupil’s inner circle are a pretty big influence on those who end up making adventurous career choices.”

DISCUSSION

This study investigated the type and amount of education- and career-related discussions between different groups of socializers and ninth graders, and the extent to which these socializers hold gender-based views regarding occupational stereotypes. This study was unique in that these issues were explored by examining the perspectives of both ninth graders and their school guidance counselors. The results of the study contribute to the research and development of new ways of targeting socializers in the pursuit of de-segregation in STEM fields.

The results of the study indicate that ninth graders have most discussions regarding their education- and career-related choices with their parents, friends, and school guidance counselors, with parents topping this list. However, almost one-third reported that they didn’t listen to anyone when making these kinds of decisions. The school guidance counselors interviewed for the study suggested that, while adolescents often claim to make such choices individually, in reality parental participation in the career-choice process and the views and choices of friends seem to be particularly influential factors.

The results also revealed that education- and career-related discussions between subject teachers and ninth graders are minimal; only a couple of ninth-graders reported heeding their teachers’ advice the most when making such decisions, and most of the guidance counselors’ responses supported this claim. Most of the guidance counselors considered that subject teachers’ influence on adolescents’ plans for the future is also minimal.

The guidance counselors considered that the pupils’ parents were the main source of occupational gender stereotypes. This finding supports the well-established hypothesis that parents’ beliefs and stereotypes have the biggest influence on their
children’s gender-role socialization (e.g. Eccles, Frome, Yoon, Freedman-Doan, & Jacobs, 2000). On the other hand, most of the ninth graders were unable to say whether their parents held views about occupations that were gender-stereotyped; their survey responses indicated that they might not have been aware of their parents’ views, maybe due to them having relatively few discussions with their parents in which gender issues might have intersected with career planning. However, both ninth graders’ survey responses and the guidance counselors’ interview responses indicate that gender-stereotypical perceptions of occupations are clearly present in conversations in friend groups, and that pupils pursuing vocational education after compulsory education seem to be particularly exposed to their friends’ gender-stereotypical views.

In pursuing de-segregation in STEM, it is not enough that only young people are targeted with campaigns and educational interventions; it should also be considered how the socializers who have the biggest role in young people’s career planning could be deployed as mediators of STEM career knowledge and critique related to occupational gender-stereotypes. The results of this study suggest that adolescents’ gendered choices result partially from having many education- and career-related discussions with these socializers, who are most likely to hold gender-based stereotypical perceptions of occupations and may not have up-to-date knowledge about STEM career possibilities (e.g. Archer & Dewitt, 2015).

Parents evidently play the most important role in helping adolescents to choose their career and are also the main mediators of cultural gender stereotypes. According to our study, even school guidance counseling plays second fiddle to the influence of parents in adolescents’ career planning. Thus, we suggest that future research should be geared towards developing new methods and materials to promote parent-adolescent communication regarding the benefits of studying STEM courses and the career possibilities in STEM fields. Earlier studies have indicated that interventions increasing parent–child communication promote both parents’ and adolescents’ perceptions of the usefulness of STEM courses and increase adolescent enrolment onto STEM courses during high school (e.g. Harackiewicz, Rozek, Hulleman, & Hyde, 2012). We suggest that parents should be offered information about further education in STEM subjects and STEM occupations, along with tools to help their children to identify their own skills and attributes and find out more about which STEM occupations they could use the in. Increasing cooperation between STEM education, school guidance counseling and families is therefore recommended.

Besides talking about the value of STEM courses and STEM career possibilities, however, we suggest that parents should be encouraged to talk about the general effect of gender when discussing matters relating to educational and career choices with their children. Thinking about traditional gender expectations and stereotypes regarding skills and abilities will help adolescents to recognize and question widely held beliefs that may be limiting their own choices regarding their education and career. Educational practitioners such as guidance counselors should provide parents with tools with which, together with their children, they could critically examine gender-stereotyped perceptions of occupations that may occur in their family, in their children’s social groups or in the media.
There is a vast amount of evidence to support the suggestion that parents’ socio-economic status influences high-school pupils’ academic performance and educational choices. PISA 2015, showed that socio-economic status remains a strong predictor for science performance amongst OECD countries (OECD, 2016). Archer et al. (2012) argue that families in higher social classes have more cultural and social capital with which to realize their children’s career aspirations and identifications with science, while Archer & Dewitt’s (2015) study indicates that girls from middle-class families are more likely to develop and sustain hopes of pursuing a science-related career than those of working-class families. We suggest that future studies should explore more thoroughly the influence of socio-economic status on occupational gender stereotypes among young people and their families. It would also be a valuable exercise to investigate how parents’ academic backgrounds and occupations influence the education- and career-related discussions they have with their children, and whether the nature of these discussions differ depending on the child’s gender.

As the sample of ninth graders in this study perceived that their friends held gender-based stereotypes regarding certain jobs more than any other group of socializers, it is clear that friends represent a crucial target group in pursuing de-segregation. Future research should therefore be conducted to develop educational interventions that stimulate friend-group discussions regarding not only the value of STEM courses and STEM career possibilities but also occupational gender stereotypes and gender-biased beliefs related to science and math. As mentioned in the Introduction of this article, the support of friends has been found to have a positive influence on teenage girls’ motivation to pursue a career in science and mathematics (Leaper et al., 2012). It would be worthwhile to harness this influence in cultivating female students’ motivation to pursue STEM careers.

As previously mentioned, this study revealed that the sample of ninth graders rarely discussed education- and career-related matters with their math, physics, and chemistry teachers. Earlier studies have indicated that teachers with encouraging attitudes can promote students’ interest in choosing a career in science or engineering (Buschor, Kappler, Keck, & Berweger, 2014; Dick & Rallis, 1991; Hazari, Sonnert, Sadler, & Shanahan, 2010), while Dick and Rallis (1991) argue that teachers may play a particularly important role in influencing the career choices of female students orienting towards science or engineering. We therefore suggest that, while pursuing de-segregation in STEM and aiming to increase the number of pupils orienting towards these fields, subject teachers start to play a bigger role in pupils’ career planning. Developing methods and materials is essential for helping subject teachers to give pupils interested in pursuing a STEM career the most up-to-date advice, showing the connections between STEM subjects and working life, and introducing different types of STEM professional role models. This is particularly true in Finland, where compulsory basic education has started to implement a revised national core curriculum focusing specifically on physics and chemistry with a view to increasing pupils’ awareness of educational pathways and occupations that require skills in these subjects (FNBE, 2014, p. 418, p. 424).
REFERENCES


ARTICLE II
Finnish Ninth Graders’ Gender Appropriateness of Occupations

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1 University of Eastern Finland, FINLAND
2 Western Norway University of Applied Sciences, NORWAY

ABSTRACT

In this study, Finnish ninth graders’ and their school guidance counselors’ views concerning ninth graders’ perceptions of gender-appropriateness of occupations were examined. Special interest was placed on evaluating if ninth graders bring out any gender stereotypical perceptions regarding science, technology, engineering or mathematics (STEM) occupations. The data were gathered with the aid of an online survey (246 pupils) and semi-structured interviews (7 school guidance counselors). Ninth graders referred mostly to masculine physical dimension when justifying certain occupations being more suitable for men than for women. Respectively, they referred mostly to gender-typical interest when justifying certain occupations to be more suitable for women than for men. Boys presented more gender stereotypical perceptions of occupations than girls did. Boys also considered their own gender affecting their occupational preferences stronger than girls did. Guidance counselors reported ninth graders’ perceptions of occupations being still very gender-stereotypic and influencing on academic and occupational choices. To address occupational gender segregation, it is necessary to develop novel methods and materials recognizing gender stereotypes and demonstrating up-to-date STEM career knowledge.

Keywords: career choice, gender, stereotypes, STEM

INTRODUCTION

In Finnish education and labor market, gender segregation is a persistent phenomenon; changes in segregation levels in recent 30 years are minimal. Our young generations still aspire similarly gender stereotypical educational pathways and occupations as their parents and grandparents aspired. Gendered educational choices start to occur already on middle school level, where male and female pupils make different subject selections. In Finnish education system, adolescents typically orient to either general or vocational upper secondary education after compulsory basic education. On general upper secondary education, course selection continues to be gendered as female students opt less likely to advanced mathematics and physics courses (Pursiainen, Muukkonen-Van der Meer, Rusanen, & Harmoinen, 2018). In secondary vocational education, male and female students choose different educational tracks; the tracks of science, technology and transport are strongly male dominant and the tracks of education or health and welfare are, in turn, strongly female dominant (Statistics Finland, 2016). In higher education, as in universities and universities of applied sciences, female students orient towards the fields of life sciences more likely than the fields of engineering, physical sciences or applied mathematics (Statistics Finland, 2016).

When it comes to Finnish labor markets, the industries of human health and social work activities, accommodation and food service activities, and education are three of the industries with the strongest female-domination. The most male-dominated industries are, in turn, construction, transport and storage and agriculture, forestry, fishing, and mining. Science and engineering professionals are two of the principal occupations of Finnish employed men whereas the principal occupations of Finnish women are personal care workers, teaching
expectations in their gender ideology, and adapt to the roles, behaviours, activities, can be explained with gender role theories, according to which individuals internalize cultural gender role
gender-type occupations. Gottfredson argues that occupations that are inappropriate for one’s gender, are the first
theory of the development of occupational aspirations, young children have quite positive images of all occupations
they are aware of, but with age, as the self-concept develops, one’s perceptions of acceptable occupations become
narrower. The orientation to gender roles starts in the ages of 6-8, and already in that age children have found to
Foundation, 2019).
not only in Finland but also in the European Union and the United States (Caprile et al., 2015; National Science
Finland, 2018). Hence, sufficient supply particularly of STEM skilled labor is essential. Besides not enough young
workforce able to operate with them.
Shortfalls of STEM skilled workers cause concern globally. Besides newly created jobs, companies are growing,
and large age groups are starting to retire during the following few years (Caprile, Palmén, Sanz, & Dente, 2015;
Heimlich, 2010). The supply of workforce does not meet the demands of labor markets in many countries because
not enough young people are entering STEM fields and the current work force is partly in need of reskilling and
upskilling. In Finland, economic model is based on high competence and the availability of skilled and high-quality
workforce is a key factor for sustaining economic growth, correcting the demographic dependency ratio and
financing the welfare state. Technology industry, chemical industry and forestry are the largest industries in
Finland and their products account approximately for 80 per cent of the Finnish exports (Official Statistics of
Finland, 2018). Hence, sufficient supply particularly of STEM skilled labor is essential. Besides not enough young
people are entering STEM fields, additional problem is the persistent underrepresentation of women in these fields,
not only in Finland but also in the European Union and the United States (Caprile et al., 2015; National Science
Foundation, 2019).

LITERATURE REVIEW

International studies on student achievement, such as Trends in International Mathematics and Science Study
(TIMMS) and the Programme for International Student Assessment (PISA) from past several years have
documented a narrowing gap in gender differences in science and mathematics achievement (Else-Quest, Hyde, &
Linn, 2010; Martin, Mullis, Foy, & Hooper, 2016; OECD, 2016). Growing body of research on career choice concludes
that actual abilities are just one of factors influencing on individual’s educational and occupational preferences and
that they do not justify girls’ retention from STEM career pathways. Wang and Degol (2017) summarize in their
meta-analysis that female underrepresentation in STEM fields is a complex interaction of six underlying factors:
absolute ability differences, relative ability strengths, career preferences, lifestyle preferences, field-specific ability
beliefs, and gender stereotypes and bias.

Miller and Hayward’s (2006) review of studies from 1970s onwards demonstrates that the extent to which
occupations are seen as gender-stereotyped is one of the most influential factors affecting career choices and that
individuals mostly prefer occupations that they consider gender-appropriate. Behind the perceptions of gender-
appropriateness of occupations, there are beliefs, that men and women are suited into different kinds of occupations
because of their gender-typical personal characteristics (Cejka & Eagly, 1999). According to Gottfredson’s (1981)
theory of the development of occupational aspirations, young children have quite positive images of all occupations
they are aware of, but with age, as the self-concept develops, one’s perceptions of acceptable occupations become
narrower. The orientation to gender roles starts in the ages of 6-8, and already in that age children have found to
gender-type occupations. Gottfredson argues that occupations that are inappropriate for one’s gender, are the first
tones to rule out from further consideration. The elimination of gender-wise inappropriate occupational alternatives
can be explained with gender role theories, according to which individuals internalize cultural gender role
expectations in their gender ideology, and adapt to the roles, behaviours, activities, and attributes that a given
society may construct or consider appropriate as doing so establishes their identity (Akerlof & Kranton, 2000;
Sinclair & Carlsson, 2013). The exploration of occupational alternatives in adolescence is largely within the set of
occupations that were deemed compatible at earlier ages according to one’s more visible social attributes (sex, social class, and intelligence) and one’s sense of what is available with reasonable effort (Gottfredson, 1981).

One model describing gender-typical personal characteristics linked to men and women is a Description of Gender-Stereotypic Dimensions derived by Cejka and Eagly (1999) (Table 1). The gender stereotypicality of each of the six dimension was established by comparing university psychology students’ ratings of the likelihood that an average man or an average woman would possess some of the 54 attributes listed in the Table 1.

In their study, Cejka and Eagly (1999) investigated the extent to what psychology students believed that success in occupations dominated by one gender requires personal characteristics typical for that gender. Psychology students rated stereotypic masculine cognitive characteristics (such as analytical, mathematical and good at abstraction) as the most important features for success in male-dominated occupations and stereotypic female personality characteristics (affectionate, nurturing and cooperative, for example) as the most important ones for success in female dominated occupations. Students also believed that highly paid occupations require masculine personality characteristics and prestigious occupations require both masculinity and cognitive characteristics. Cejka and Eagly argue, that beliefs like this can discourage women orienting towards highly paid occupations dominated by one gender.

Concerning gender stereotypes regarding STEM occupations, earlier research has documented that children and adolescents often link these occupations to men or stereotypical male characteristics. A common way of investigating young people’s perceptions regarding scientists has been the Draw-a-scientist (DAST) –test developed by David Wade Chambers in 1983. Several decades of research utilizing this test document that young people tend to visualize a scientist as a male person in a laboratory coat, eyeglasses and facial hair (Barman, 1997; Chambers, 1983; Finson, 2002; Narayan, Park, Peker, & Suh, 2013). There have also been studies examining drawings of engineers and in these studies, too, young people usually draw a male engineer (Karatas, Micklos, & Bodner, 2011).

Gender stereotypes related to STEM skills and occupations seem to partially result to girls feeling that careers in these fields are not for them. Masculine images of STEM professionals are in conflict with girls’ gender-identity especially in adolescence when the pressures of fulfilling feminine norms in social circles becomes harder. In addition, stereotypes of male superiority in science and mathematics inhibit girls’ self-efficacy in these subjects in school and lower their interest to orient towards science and mathematics-intensive careers (Correll, 2001).

The amount of Finnish research regarding adolescents’ gender stereotypes of occupations is marginal. Picker and Berry (2000) investigated adolescents’ images of mathematicians, and found out that when asked to draw a mathematician, majority of Finnish pupils that participated in the study, drew a male mathematician. In 2010, Technology Industries of Finland studied Finnish girls’ perceptions of the field of information and communication...
technology (ICT) in general and the companies, products and services on ICT. In this study, girls perceived ICT
difficult and lacking creativity and humanity. On the other hand, girls considered that ICT is suitable for women
but regardless they did not see themselves working in this field. (Technology Industries of Finland, 2011).

While gender stereotypes may have an influence on adolescents’ perceptions of their ability to succeed in STEM
occupations and the gender-appropriateness of orienting towards them, further examination of adolescents’
occupational gender stereotypes is vital in countries with highly segregated labor markets, such as Finland.
Therefore, this study concentrates on examining Finnish ninth graders’ perceptions of gender-appropriateness of
occupations with the aid of the Description of Gender-Stereotypic Dimensions according to Cejka and Eagly (1999)
(see Table 1).

Ninth graders were chosen as a cohort because the ninth grade is the point of time when Finnish adolescents
are finishing their compulsory education and are making further educational and occupational choices. According
to the study of Maltese and Tai (2011), the majority of college students who concentrate in STEM make that choice
during high school. Thus, finding out what kind of gender-related perceptions on occupations ninth graders have
and how STEM occupations occur in these perception can contribute to developing novel educational methods and
materials enhancing pupils knowledge on STEM occupations and tackling gender segregation in STEM already in
secondary level education.

In this study, school guidance counselors’ views are examined alongside with ninth graders’ views, as guidance
counselors have a central role in education and career related discussions in middle school environment. In Finnish
education system, guidance counselors provide pupils information of working life and entrepreneurship, and
discuss pupil’s post-comprehensive school plans for education and career (CIMO, 2009). Thus, school guidance
counselors assumedly possess notable amount of experience-based knowledge on adolescents’ perceptions of
occupations.

For this study, the following research questions were formulated:

(1) What kinds of perceptions regarding gender-appropriateness of occupations do Finnish ninth graders have?
(2) To what extent do ninth graders consider their own gender influencing their career preferences?
(3) How do STEM occupations occur in ninth graders’ views regarding gender-appropriateness of occupations?

Guided by the research question (1), it is investigated to what extent ninth graders think that there are
occupations that are more suitable to certain gender and to what kind of gender typical characteristics, they refer
to when justifying their views. In addition, ninth graders views regarding the influence of their own gender to their
career preference, is examined guided by research question (2). Special interest of this study was to examine how
STEM occupations possibly occur in ninth graders’ gender-related perceptions of occupations without questions
that address explicitly to that aspect. This approach may reduce the risk of questions influencing on the responses.
For this aim, the research question (3) was formulated.

Each of the research questions 1-3 are evaluated from the perspectives of ninth graders and supplementary data
for each question is collected from their school guidance counselors.

METHODOLOGY

Data Collection Methods

To examine ninth graders’ perceptions of gender-appropriateness of occupations and the effect of their own
gender on educational and occupational choices, a survey instrument (Trochim, 2006) was designed in a group of
four researchers. The survey instrument consisted of demographic questions, Likert-scale statements, and comment
boxes in which pupils were encouraged to justify their responses to the statements. The aim was to gather
information for the following themes:

(a) Background information: the respondent’s gender, home town, school and grade.
(b) The extent to what respondent considers that some occupations are more suitable for women or for men.
(c) Respondents’ justifications for his/her perceptions regarding theme (b).
(d) The extent to what respondent considers that his/her gender has an effect on his/her career preference.

There were 27 questions Altogether in the final survey instrument. In this article, pupils’ responses concerning
three questions corresponding the themes (b)-(d) are reported. Another part of the data collected with the same
survey instrument from the same sample concerns education- and career-related conversations between different
groups of socializers and ninth graders, and the extent to which occupational gender stereotypes are present in
these conversations. This data is reported in a separate research article (Ikonen, Leinonen, Asikainen, & Hirvonen,
2018).
The survey was piloted with 73 ninth grade pupils from one school located in Southern Finland on their guidance counselling lessons. Based on the feedback received from the pupils and their school guidance counselor, one ambiguous question was reformulated.

For the final data collection, 24 school guidance counselors in the Eastern Finland area were contacted and asked to conduct the survey during their ninth graders’ school guidance counselling lessons. Eight guidance counselors agreed to conduct the survey in their lessons. The final survey was administered online, which made it easier for the guidance counselors to distribute it to their pupils. The pupils were offered a chance to refuse to participate in the study.

In order to supplement the survey data, guidance counselors’ views were explored via interviews. A semi-structured interview protocol (Galletta, 2013) was designed in a group of four researchers. Design process was based on results of earlier research findings and the research gap that was discovered during the literature review to form a framework for the interview questions. The interview consisted of 20 questions and it included themes concerning the social influences on adolescents’ education- and career-related views and choices in general and in the aspect of gender-typing. In this article, we focus only on guidance counselors’ responses to those interview questions related to adolescents’ occupational gender stereotypes and on comparing their views with the ninth graders’ views. The rest of the interview data is reported in the same research article that was referred to earlier in the case of ninth graders’ survey data (Ikonen, Leinonen, Asikainen, & Hirvonen, 2018).

The interview protocol was piloted with one guidance counselor. Based on the notions made during the pilot interview, the final interviews were decided to conduct by means of semi-structured interviews (Galletta, 2013) so that the interviewer was allowed to change the order of the questions and ask additional questions to address all the themes intended. Author 1 conducted the actual interviews as phone interviews with seven school guidance counselors from Eastern Finland area. The interviews were recorded with a digital voice recorder by having the phone calls on speaker. The interviews lasted on average an hour each. After the recordings, Author 1 transcribed the interviews for the analysis.

Sample

Altogether 348 ninth graders in the Eastern Finland area responded to the survey. We included a trap question in the survey, and due to the erroneous responses to the trap question, 246 pupils (96 male, 150 female) were included in the analysis.

When contacting the school guidance counselors for conducting the survey in their lessons, they were also asked for participation in the interviews. Out of the eight guidance counselors who conducted the survey with their pupils, seven agreed to participate in the interviews, as well.

Data Analysis Methods

With the ninth graders responses to the Likert scale statements, Mann-Whitney U test (Davis, 2013) was utilized to determine if there were significant differences between the perceptions of boys and girls.

Pupils’ justifications to the statements were examined qualitatively by adapting and dividing their justifications into categories depending on what gender-stereotypic dimensions were observed in them. Author 1 made the categorization and unclear justifications were discussed with other authors to find the consensus about the best category. The categorization was based on the dimensions by Cejka and Eagly (1999). During the analysis process, it was discovered that besides dimensions physical attributes, personality attributes and qualities of cognition being present in the data, two additional categories, gender-typical interest and others, are required.

Concerning the guidance counselors’ interview data, content analysis (Mayring, 2000) was used as a method whilst examining differences and similarities between the guidance counselors’ views and experiences. Author 1 started the analysis with defining the categories by inductive category development. With each interview questions, main categories for guidance counselors’ responses were defined by reviewing all the responses and finding similarities and differences in guidance counselors’ views. This inductive category development was executed by Authors 1 and 2 individually. Later, disagreements between researchers’ category development and classification of the interview responses were discussed and compromised. Finally, guidance counselors’ views were compared with the ninth graders views that mediated through the survey responses.

To enable the reader to evaluate our analyses and conclusions, authentic examples of the ninth graders survey responses and guidance counselors’ interview responses are presented in the results section.
In this section, ninth graders’ survey responses are presented first with authentic examples of both boys’ and girls’ responses. After that, school guidance counselors’ views related to ninth graders’ perceptions of gender-appropriateness of occupations are presented, also with authentic examples of their interview responses.

**Ninth Graders’ Perceptions of Gender-appropriateness of Occupations**

The percentages of ninth graders that slightly agreed or agreed to the Likert scale statements presented in the survey are presented in Table 2. In every gender-related statement, there was a statistically significant difference between the responses of boys and girls. This means that boys’ perceptions of gender-appropriateness of occupations were stronger than those of girls’. Boys also considered their own gender affecting their occupational preferences stronger than girls did.

The frequencies of gender-stereotypic dimensions occurring in ninth graders justifications to the aforementioned Likert scale statements 1 and 2 are presented in Table 3. A few justifications seemed to support the statements, even if the respondent had disagreed in the Likert scale. We included those cases in Table 3. As some justifications included attributes of more than one dimension, one justification can be placed in more than one category simultaneously. Justifications that did not contain any of the gender-stereotypic dimensions were placed in the category of others.

Statement number 3 was not included in this table because only twelve respondents justified why they agreed to the statement number 3. We show discretionally four examples of what kind of justifications ninth graders gave for the statement 3.

**Girls’ perceptions**

Overall, 55 (36%) girls agreed to the statement number 1, *some occupations are more suitable for women than for men*, and 36 girls represented views supporting it in the comment box. Out of these girls, 17 mentioned occupations that they considered more suitable for women than for men, but they did not justify their views by explicitly referring to any of the gender-stereotypic characteristics. Two girls reported their observations of female-dominance on some occupations. Responses like these are included in the category others. Majority of the occupations mentioned were related to health care and beauty industry. No explicit references to STEM occupations were observed. Here are three examples of these types of justifications.

Girl A: “A female nurse in a child health center is better [than a male nurse].”

Girl B: “Some occupations are more suitable for women, a cosmetologist for example.”

Girl C: “Some occupations just are female dominated, a hairdresser for example.”

When it comes to the gender-stereotypic dimensions, none of the girls referred to *feminine personality attributes* when justifying their responses to the statement 1 related to certain occupations being more suitable for women than for men.
Three girls justified their answers by referring to physical attributes but two of these justifications referred to jobs that are more suitable for men than for women and thus were more relevant justifications for the statement 2. Girl F’s justification referred to feminine physical attributes:

Girl F: “Being petite can be an advantage in some jobs.”

Ten girls justified their responses to statement 1 by referring to feminine qualities of cognition:

Girl D: “Tasks that require precision are usually suitable for women.”

Girl E: “Clerical work is more suitable for women in some cases because women are better in staying focused.”

Four girls highlighted gender-typical interest in their justification as in the following example:

Girl G: “Mainly women enter to cosmetics industry for example, as they are more interested in that kind of things.”

All in all, 66 (44%) girls agreed to the statement number 2, some occupations are more suitable for men than for women, and 52 girls represented views supporting it in the comment box. Out of these girls, seven mentioned occupations that they considered more suitable for women than for men, but they did not justify their views by explicitly referring to any of the gender-stereotypic characteristics. Five girls reported their observations of male-dominance on some occupations. Occupations that occurred in girls’ justifications were construction worker, automobile mechanic, police officer and fire fighter. Responses like these are included in the category others.

Girl B: “Automobile mechanic, for example, is a more suitable job for men than for women.”

Not any of the girls referred to masculine cognitive attributes when justifying their responses to this statement. A majority of girls (41), referred to masculine physical attributes in their justifications. Masculine personality attributes occurred only in Girl H’s justification in which she also referred to masculine physical attributes:

Girl H: “Men are stronger and are not as scared of getting dirty as the majority of women.”

Girl J: “Jobs that require muscles. A constructions laborer, for example.”

Two girls highlighted gender-typical interest in their justification. In her response, the other of these girls also brought out that despite men are usually more interested in certain occupations, so can be some women, too:

Girl J: “Men are probably more interested in electrical work and woodwork than women are, but there are talented women as well. It depends on what one likes to do.”

Like in the case of statement 1, references to STEM occupations were absent in the case of statement 2.

Of the 24 (16 %) girls who agreed in the statement 3, my gender has an influence on what occupations I consider suitable for myself, only six offered a justification for their response. Masculine physical attributes occurred in three of the justifications.

Girl K: “I would not be able to work in some of the ‘male’ jobs because they are physically too hard or too messy for me.”

Girl L: “Some jobs that are physically very demanding can be almost impossible for me.”

In the rest of justifications, the gender-typical dimensions were not clearly present. One of the girls reported fears of not getting a job because of its male dominance and another thought that some jobs are not suitable for her because of her gender.

Girl M: “I am interested in the career of a boarding guide but I am afraid I will not be able to work on that field because it is more common for men.”

Girl N: “I am not suitable for the jobs of police officer or bouncer because I am a woman.”

**Boys’ perceptions**

Overall 51 (53%) boys agreed to the statement number 1, some occupations are more suitable for women than for men, and 25 boys represented views supporting it in the comment box. 17 of them reported an occupation or several occupations that they considered more suitable for women than for men. These respondents did not justify their views by explicitly referring to any of the gender-stereotypic characteristics, and thus they are included in the category of others in table 3. Beauty and health care related occupations were the most commonly mentioned ones similarly to the girls’ views introduced above. Other domains that boys mentioned more suitable for women were cooking, cleaning, teaching and crafts. References to STEM fields were absent here.

Boy A: “Make up products, for example, are more familiar to women than for men.”

Boy B: “Women are better in cooking, cleaning and teaching.”

One of the boys wrote:

Boy C: “Some occupations are ‘embarrassing’ for men.”
None of the boys referred explicitly to feminine personality attributes or feminine physical attributes when justifying their responses to the statement number 1 related to certain occupations being more suitable for women than for men.

Six of the boys justified their responses by referring to feminine qualities of cognition and one of them included also the aspect of gender-typical interest in his justification:

Boy D: “Nowadays women are maybe a bit more eager to educate themselves than men are and they will get better jobs, too… However, there are certain occupations that men are simply not interested in."

Boy E: “Women may be a bit more intelligent and niftier than men are.”

Overall, 59 (61%) boys agreed to the statement number 2, some occupations are more suitable for men than for women, and 25 boys represented views supporting it in the comment box. Five of them reported occupations that they considered more suitable for men than for women. Occupations that occurred these responses were construction laborer and truck driver. One of the boys stated that women just are not capable of doing some things that men are capable of doing. No any of these respondents justified their views by explicitly referring to any of the gender-stereotypic characteristics, and thus they are included in the category of others in Table 3.

Overall, 19 boys referred to masculine physical attributes in their justifications and they mentioned occupations like construction laborer, miner, fire fighter and police officer, similarly to girls in their justifications.

Boy F: “In some occupations, physical strength is required. A firefighter is an example of such occupations.”

No other gender-typical dimensions occurred in boys’ justifications and no explicit references to STEM occupations were observed in the case of statement 2.

Of the 31 (32%) boys who agreed in the statement number 3, my gender has an influence on what occupations I consider suitable for myself, only six offered a justification for their response. Gender stereotypic dimensions did not occur in their justifications. Boys reported that some female dominated occupations simply are not suitable for them or that they believe others thinking in that way:

Boy G: “As a male, I do not consider working in the cosmetics industry suitable for myself.”

Boy H: “Some people prefer female doctors, for example.”

School Guidance Counselors’ Views related to Ninth Graders’ Perceptions of Gender-appropriateness of Occupations

Each one of the seven interviewed school guidance counselors (abbreviated as GC1-7 in the examples of the interview responses) had noticed some of their pupils holding gender stereotypical ideas of occupations. The ideas that guidance counselors brought out represented masculine physical and feminine personality attributes (Cejka & Eagly, 1999). The occupations that guidance counselors reported their pupils often consider more suitable for men were truck driver, technical professions and jobs related to national defense and emergency services. No other STEM occupations besides technical professions occurred in guidance counselors interview responses. The occupations that guidance counselors reported their pupils often consider more suitable for women, in turn, were social and healthcare related jobs, cosmetologist, hairdresser and artisan.

GC1: “They think that engineering and jobs related to national defense and emergency services are for men. Respectively, they think that especially jobs related to textile crafts are for women.”

GC4: “Here at the rural area pupils hold quite traditional ideas of occupations… Ideas of male and female jobs… It is still quite a strong phenomenon here.”

GC7: “The ideas are terribly stereotypical actually. An image of a man working with machines persists. In turn, childcare and healthcare are linked to women.”

One of the guidance counselors brought out that especially boys hold gender-stereotypes of occupations.

GC3: “Boys have these persistent ideas that certain jobs are not suitable for girls or women, for example a truck driver or other jobs related to motoring.”

Guidance counselors were asked, if adolescents rule professional fields dominated by the opposite gender out during their educational and occupational choice process.

GC3: “Well, I do not think that they are absolute with this. I do not think that they rule out any professional fields outright because of that. But, for sure it has an influence on their occupational plans.”

GC5: “Boys usually rule out the occupation of a hairdresser at least. They think that it is not their cup of tea. In general, I do not know… Some adolescents may rule out certain occupations because of that.”

GC7: “I do not know how conscious that is. But in fact, sometimes they immediately say ‘no’ to some occupations when we explore different options. Therefore, it might be true.”
Generally, it can be seen that guidance counselors’ views are in agreement with ninth graders’ survey responses in a sense that adolescents’ views regarding gender-appropriateness of occupations are still very common. Gender-stereotypic perceptions are clearly present in guidance counseling and influence on adolescents’ educational and occupational choices.

**DISCUSSION**

This study investigated Finnish ninth graders’ and their school guidance counselors’ views regarding ninth graders’ perceptions of gender-appropriateness of occupations. Special interest was placed on evaluating if ninth graders bring out any gender stereotypical perceptions regarding science, technology, engineering or mathematics (STEM) occupations. Knowledge gained in this study indicates what type of career education related interventions are required in middle school level for enhancing ninth graders’ ability to make more informed decisions concerning their future and to challenge persistent gender segregation patterns in today’s education and working life.

The results of our study suggest that the long-standing cultural stereotypes of women being more selfless, caring and concerned about others, than men (Eagly & Steffen, 1984; Kite, Deaux, & Haines, 2008), may be still thriving amongst the young people in Finland. Finnish ninth graders participated in the study considered that especially beauty, healthcare and childcare related occupations are more suitable for women than for men and justified their views by stating that women are more interested, competent or simply more suitable for these occupations. In the study of Cejka and Eagly (1999) students clearly associated success in female-dominated occupations with stereotypical female personality attributes, such as being gentle, nurturing and helpful to others. These kinds of views might have also been underlying in the justifications of the sample of ninth graders in this study.

Our results also suggest that Finnish ninth graders referred to attributes physically strong and daring when thinking about jobs suitable for men. Ninth graders considered the jobs such as construction laborer, firefighter, truck driver and police officer more suitable for men than for women since these jobs require physical strength which men in most cases possess more than women do. However, in the study by Cejka and Eagly (1999), students rated masculine physical attributes only somewhat important but masculine cognitive attributes as most important for success in male-dominated occupations even though the male-dominant occupations included jobs like construction laborer and truck driver.

The interviewed school guidance counselors had also noticed their pupils holding gender stereotypical views of occupations. The occupations that guidance counselors reported their pupils usually linking to certain gender, were similar with those which occurred in ninth graders’ survey responses; occupations in female-dominated fields of healthcare and beauty and occupations in male-dominated construction branch and firefighting. According to the guidance counselors, adolescents rule sometimes whole fields out of their preference, if the occupations in the field are dominated by the opposite gender. This happens typically with boys and beauty industry.

The results show that Finnish boys’ views regarding gender-appropriateness of occupations were stronger than those of girls’. Boys also considered their gender affecting their own occupational preferences stronger than girls did. One of the guidance counselors’ views were in line with the survey responses, as he/she reported observations of male pupils holding more segregation-oriented perceptions than female pupils. Therefore, these findings are similar to earlier research findings (Francis, 2002; Miller & Budd, 1999; Miller & Hayward, 2006). The results of this study suggest that especially boys should be supported in questioning stereotypes concerning genders and jobs. Individual school guidance counseling could be a good environment in helping boys in career exploration without social pressure and gender-expectations.

It was surprising that Finnish ninth graders’ survey responses did not include perceptions of gender-appropriateness of STEM occupations. Not girls nor boys report any STEM occupation being more suitable for certain gender. Neither did any of them bring out stereotypical masculine cognitive attributes (Cejka & Eagly, 1999) such as mathematical, good with numbers or good in problem solving, which are traditionally associated with competence in STEM jobs. In addition, views related gender differences in the interest towards the fields of science, mathematics, technology or engineering, were absent. These results suggest that gender stereotypes related to STEM occupations are not as strong among ninth graders as the stereotypes concerning the more traditional occupations such as nurse, construction laborer, and truck driver. It might have also been so that STEM occupations are not familiar enough amongst ninth graders so that they could have brought out their perceptions of them in a study like this. With regards to the sample, future research should investigate, if stereotypes regarding cognitive attributes occur more frequently amongst upper secondary school students than with ninth graders. The importance of mathematics skills in STEM careers may become more evident at upper secondary level, which is an essential point of time for making choices related to higher education and career.

The results of this study cause concern regarding the state of STEM career knowledge amongst adolescents. The underlying reason for the total lack of STEM related views in this study may be the fact that STEM jobs do not
become as familiar to adolescents in everyday life as do the more traditional occupations, such as teachers, salespersons, police officers or nurses. On the other hand, it is a positive signal that no stereotypes regarding male superiority in math, science and technology occurred. However, the survey did not include closed-ended questions regarding gender-appropriateness of occupations, which would have deepened the results. Also interviewing adolescents would have been beneficial in obtaining more profound data on occupational stereotypes.

Earlier research on students’ perceptions of scientists have shown that students do not have a clear perception of what science has to offer them or what scientists do (Wyss, Heulskamp, & Siebert, 2012). Similar evidence has been given also about ICT jobs (Technology Industries of Finland, 2010) and mathematicians’ job (Picker & Berry, 2000). Considering future research, interesting knowledge would be gained by exploring pupils’ awareness on STEM occupations and the skills and attributes that STEM occupations nowadays require and comparing their ideas with the actual job descriptions from STEM professionals. In addition, the impact of insufficient career knowledge or false perceptions of occupations may have on especially girls’ retention of STEM careers, should be investigated more.

More attention should be paid in secondary level STEM subject teachers’ ideas on their STEM career knowledge and their attitudes on incorporating it into subject teaching. In addition, even though the role of schools in making young people ready for working life is often emphasized, earlier research gives only limited insight into the extent and ways of actual career-related activities that STEM subject teachers are currently embedding into their lessons and how effective they are in terms of pupil engagement. The study of Ikonen, Leinonen, Asikainen, and Hirvonen, (2018) revealed that education and career related discussions between STEM subject teachers and ninth graders are minimal; in this study only a couple of ninth-graders reported heeding their teachers’ advice the most when making such decisions. The study of Sherman-Morris, Brown, Dyer, McNeal, and Rodgers (2013) regarding teachers’ knowledge of geoscience and biology careers suggest that if teachers have less knowledge of these careers, they may have difficulties in incorporating examples of those careers in their classes. On the other hand, earlier studies have indicated that teachers with encouraging attitudes can promote students’ interest in choosing a career in science or engineering (Buschor, Kappler, Keck, & Berweger, 2014; Dick & Rallis, 1991; Hazari, Sonnert, Sadler, & Shanahan, 2010). Dick and Rallis (1991) argue that teachers may play a particularly important role in influencing the career choices of female students orienting towards science or engineering. Therefore, we suggest that STEM subject teachers should be better supported in providing up-to-date career advice, showing the connections between STEM subjects and working life, and introducing different types of STEM professional role models to pupils. Supporting STEM subject teachers in incorporating career education in classes is in demand in Finland where compulsory basic education has started to implement a revised national core curriculum in which entrepreneurship and skills for working life are two of the aims set for transversal competences (FNBE, 2014, p. 24-25). The curriculum also emphasizes now particularly on physics and chemistry with a view to increase pupils’ awareness of careers that require skills in these subjects (FNBE, 2014, p. 418, p. 424).

CONCLUSION

This study documents that Finnish ninth graders’ perceptions of gender-appropriateness of occupations in general are strong, which may partially explain why young people in Finland still make such traditional career choices. Researchers from other countries that are suffering from segregated labor markets have highlighted, that young people lack the knowledge that is required to make informed decisions about careers (Francis, 2002) and they should be provided with career knowledge also of the ‘atypical’ fields already in younger age, before the key career plans are made (Miller & Hayward, 2006). In Finland, more attention should be paid in the career education, already at the elementary level, and encourage children and adolescents to examine and challenge traditional gender roles and occupational gender stereotypes. Developing novel educational methods for supporting children and adolescents to consider a wider range of occupations, is definitely required.

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Ikonen et al. / Ninth graders’ gender-appropriateness


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This dissertation addresses the contribution of socio-cultural factors to Finnish adolescents’ gendered education and career exploration, particularly from the perspective of the fields of science, technology, engineering and mathematics. The study is composed of three sub-studies, each of which explores the main topic from a particular viewpoint. The results of the study are useful in the development of educational interventions that encourage adolescents in developing and supporting their interests and aspirations.