

The hidden gender gap in Swedish and Dutch higher education

How has Sweden managed to achieve a smaller gender gap among students in the STEM field of study in higher education compared to the Netherlands?



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Executive summary

The main purpose of this research is to explore in what ways the gender gap could become smaller in the STEM (science, technology, engineering and mathematics) field of higher education in the Netherlands. To gain insight into this issue, research has been conducted by the Swedish approach to attempt to reduce this gap. Sweden managed to achieve a considerably smaller gender gap among students in the STEM field of study in higher education compared to the Netherlands.

To explain this difference, the research focuses on the measures that have been taken in the STEM fields of study in higher education in Sweden and the Netherlands. In addition, the cultural differences which affect female participation in these fields have been examined.

In this research, mainly qualitative research was conducted, mostly by utilising European Union documents. Primary data was gathered by carrying out three interviews which aimed to help answer the sub-questions.

The main result of this research is that the disparity in the female participation rates in STEM is caused by cultural differences. This is mainly due to the dominance of the social democrats, who are strongly in favor of equal rights for men and women, the Swedish government has been actively involved in reducing gender gaps for decades. These actions contributed to lowering the threshold for women to enter full-time jobs in the STEM sector. In this way, it became more attractive for women to opt for a degree programme in the STEM field. This was reinforced by the provision of a large number of female role models who are working in the STEM fields.

In contrast, in Dutch society it is still often assumed that STEM fields belong to men. This is caused by traditional gender roles that largely arise from the prolonged dominance of religious parties in the Netherlands. Consequently, it was difficult to change the traditional gender role-pattern in Dutch society, which makes it troublesome for women to participate in the STEM fields of study. Currently, women dominate the part-time jobs and few women enter the STEM sector, which leads to fewer role models available in this field.

It is recommended that the Dutch government takes tremendous efforts in changing social norms that govern gender roles by counteracting gender stereotypes across these fields of study. More female role models in STEM should become available to realise this. Additionally, policy makers should continue to offer a wider variety of appealing study programmes in higher education that involve STEM disciplines. These actions might encourage more girls and women to participate in study programmes in these fields. The results of these actions might be beneficial for the Dutch knowledge-based economy.

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Preface

I have always believed that gender equality has a positive influence on the self-perceptions of women and men in society. I am also convinced that gender equality in the workforce is beneficial for the knowledge-based economy of all countries in the world. I consider myself as a feminist and I am therefore interested in contributing to actions which will lead to greater gender equality in all areas of society.

Sweden's success in reducing gender gaps particularly captured my notice in the past years. During my exchange programme, I have met a lot of people from Scandinavian countries. When we discussed the differences between Dutch and Scandinavian culture and society, I became more aware of the underachievement of the Dutch government concerning their ability to reach full gender equality. Concurrently, I participated in the course 'Sociology of Gender' during my exchange. During this course, I gained profound knowledge on cross-national differences in Europe concerning the achievement of greater gender equality. I learned that Sweden, in particular, can be considered as a role model for the Netherlands at many fronts.

Even though I am not participating in a study programme in the field of STEM, it concerns me that there is a shortage of women in this field in the Netherlands. In particular, I began to wonder why study programmes in the field of STEM tend to be male dominated at the Hague University while the participation of female students tends to be high compared to the male representation in the European Studies programme. This study programme serves as an example of a bachelor degree that does not involve any STEM-related courses. Since Swedish society appears profoundly gender equal, my aim was to determine if this tendency is also noticed across study fields in Swedish higher education.

After doing exploratory research on the differences between Sweden and the Netherlands concerning their accomplishments in reducing gender gaps in society, I found a remarkable difference between the participation rates of females in the STEM fields of study of Sweden and the Netherlands. These findings attracted my attention and have led to my decision to write my dissertation on how these differences came into being.

Acknowledgement

I would like to acknowledge the aid of my professors and especially my dissertation supervisor, Mr G.M. Lord, who guided me throughout the whole process of the research. I am honestly appreciative of the efforts Mr Lord made to steer my research proceedings in the right direction. Simultaneously, he made sure to not interfere too much with my perceptions and ideas during the process of writing the report, which I am thankful for.

In addition, the assistance of Mr R.C.M. Nijman may not go unmentioned. Mr Nijman helped me to improve my English and he was reachable when I needed guidance concerning my APA referencing. Furthermore, I speak my words of gratitude to my second reader, Ms E.M. Gabrovska. When my former supervisor was on sick leave, Ms Gabrovska helped me to make drastic changes to my research proposal. In doing so, she ensured that my research proposal was well-structured, which is essential in the startup phase of the research.

The results of the interviews that were conducted served to enrich this research remarkably. I am delighted to add my appreciation to Ms K. Sandström for participating in an interview. I particularly appreciate that Ms Sandström explained to me how the increase of female students in STEM can only be reached by including the whole society. Her knowledge provided for a deeper insight into the divergence between Dutch and Swedish society in this matter.

I would also like to thank Ms D. De Jong for her openness and her honest perceptions during the interview. I appreciate that Ms De Jong involved her personal experiences in answering the interview questions. Additionally, I am very grateful that Ms N. Jansen contributed to this research by means of providing valuable information that was very useful for my report. I appreciate that Ms Jansen was able to participate in an interview even though she was in Japan at that time and I admire her enthusiasm for the promotion of girls and women to enter the STEM fields.

Finally, I want to thank the feminist institute Atria. I visited the institute in order to gain more in-depth knowledge about the subject of my research. The employees were very helpful in providing valuable information about women in STEM. After I visited Atria, an employee of the institute sent me a report that was very relevant for my research on her own initiative, which I very much appreciated.

Abbreviations

CBS	Central Statistical Office (Centraal Bureau Statistiek)
CDEG	Steering Committee for Equality between Women and Men
CoE	Council of Europe
EC	European Commission
EIGE	European Institute for Gender Equality
EP	European Parliament
ETUCE	European Trade Union Committee for Education
OECD	Organisation for Economic Co-operation and Development
PISA	Programme for International Student Assessment
SCP	Social and Cultural Platform (Sociaal en Cultureel Planbureau)
S&T	Science and Technology
STEM	Science, technology, engineering and mathematics
UN	United Nations
UNESCO	United Nations Educational, Scientific, and Cultural Organization
VHTO	Women in Higher Technical Education (Vrouwen in Hoger Technisch Onderwijs)
WEF	World Economic Forum

Glossary of the main terms

Gender	Refers to behaviours that are linked to practices culturally designated as masculine or feminine.
Gender equality	The results of the absence of discrimination on the basis of a person's sex in opportunities and the allocation of resources or benefits or in access to services.
Gender gap	A widely-used term to describe any difference between men and women.
Gender mainstreaming	The process of assessing the implications for women and men of any planned action, including legislation, policies or programmes, in all areas and at all levels.
Gender stereotyping	A gender stereotype consists of beliefs about the psychological traits and characteristics of, as well as the activities appropriate to, men or women.
Sex	Refers to female or male human biological status.

Introduction

In a world that is becoming more dependent on technology, it is essential that girls and boys are equally encouraged to participate in a study in the field of science, technology, engineering and mathematics, often referred to as the STEM field. The demand for the products and services of technology grows internationally (Steering Committee for Equality between Women and Men (CDEG), 2011). According to Van Langen (2005), there is already a shortage of STEM- educated personnel in the European Union. This shortage is directly linked to the students' choice of secondary subjects and tertiary fields of study (Van Langen, 2005).

In the Netherlands, women remain underrepresented in the STEM fields of study compared to other European Union Member States. This shortage appears to be remarkable when looking at the female enrolment in the field of natural science, mathematics and computer science in the European Union. The Netherlands had a low ranking in the European Union with a female participation rate of 22 percent in 2011 (Merens & Van den Brakel, 2014).

If more women opt for a study programme in the field of STEM, the Netherlands can maintain and endeavour its position as one of the most competitive knowledge economies in the world (Atria, 2015b). According to the Organisation for Economic Co-operation and Development (OECD) (2015a), "Science, technology and innovation foster competitiveness, productivity and growth" (p. 264).

Accordingly, the purpose of this report is to find out in what ways the gender gap could become smaller in the STEM field of higher education in the Netherlands. Ondercin (2007) defines gender gap as follows: "gender gap is a widely- used term to describe any difference between men and women" (p. 4). The Global Gender Gap Report published by the World Economic Forum (WEF) indicates that in both Sweden and the Netherlands, there are more women enrolled in higher education than men (World Economic Forum (WEF), 2014).

However, when looking at the STEM field of education, the percentage of Swedish women in these study programmes is significantly high compared to the Dutch female participation rate (Homan, 2005). It seems that women tend to opt for different study fields than men because of stereotypical male-female differences, also referred to as gender stereotypes (Wesseling, 2014). Accordingly, the

gender gap in this report is estimated by the extent to which gender stereotyping¹ occurs in higher education rather than comparing the enrolments of women and men (Kelly & Slaughter, 2012).

Likewise, the Global Gender Gap Index ranked the Netherlands at number 14 on the Index, while Sweden was ranked number 4 (WEF, 2014). Indeed, Sweden seems to be successful in achieving greater gender equality. The European Institute for Gender Equality (EIGE) indicates that (as cited in European Commission (EC), 2010), gender equality can be defined as “the results of the absence of discrimination on the basis of a person’s sex in opportunities and the allocation of resources or benefits or in access to services” (p. 38).

Sweden does not only maintain a small gender gap in the STEM fields of study in higher education, but this country is also in the forefront of other aspects of gender equality. For instance, Sweden introduced family-friendly policies and generous welfare policies that make it easier for women to participate in full-time jobs. According to Bergman, director of the Nordic Gender Institute, these kinds of developments have led to greater gender equality in this country during several decades (Bergman, n.d). Thus, this Nordic country is acknowledged as a role model for the Netherlands concerning their high international ranking on gender equality.

In order to find out how the Netherlands can reduce the gender gap in the STEM fields of study in higher education by using Sweden as an example, it is important to find out what Sweden has done to achieve greater gender equality in STEM. In doing so, research is based on the following question: *“How has Sweden managed to achieve a smaller gender gap among students in the STEM field of study in higher education compared to the Netherlands?”*

To answer the central question, this report has been divided into five chapters. Each chapter aims to answer a different research question.

1. How are gender gap and gender stereotyping defined and how are these concepts expressed in higher education?
2. What differences are to be observed between Sweden and the Netherlands concerning the gender gap in the STEM fields of higher education?

¹ The concept of gender stereotyping is provided in the glossary (p. viii). .

3. What measures did Sweden take to reduce the gender gap in the STEM fields of higher education?
4. What can the Netherlands learn from Sweden concerning measures to increase female participation in the STEM fields in higher education?
5. How does Dutch culture hold back an increased female participation in the STEM fields of study in higher education?

Methodology

This chapter describes the methods that were utilised during the research. The basis for this description are the sub-questions which are leading into the division of each chapter. For a better understanding of the approach used, the purpose of answering the sub-questions is also discussed. Mainly qualitative methods were utilised throughout the whole research process, including the use of quantitative methods which served as a source of information for the graphs and tables that were generated and presented in this report.

How are gender gap and gender stereotyping defined and how are these concepts expressed in higher education? (Chapter 1)

The goal of answering the first subquestion was to get a better comprehension of the terms gender gap and gender stereotyping and to find out how these concepts influence students in higher education. The concepts of gender gap and gender stereotyping are used throughout the report. Therefore, it appears to be important to provide a broad and academic explanation of these concepts.

Academic internet sources such as European Commission (EC) reports were utilised in order to obtain a trustworthy explanation of the definitions. Insight and theoretical concepts from gender studies were also useful. In the second part of the chapter, studies on gender stereotypes in education and supporting theories by the European institutions have been described. Secondary data, such as reports published by the EC have been utilised to describe these theories. Since the information from the sources was able to cover multiple issues, the use of qualitative research methods was most useful (Kumar, 2012).

What differences are to be observed between Sweden and the Netherlands concerning the gender gap in the STEM fields of higher education? (Chapter 2)

In the second chapter, the differences between Sweden and the Netherlands concerning the female participation rate in the STEM fields of study in higher education were estimated. The main aim of answering the sub-question was to give evidence of the higher female participation rate of women in Sweden compared to the Netherlands in this field of study. As a complementary research method, quantitative data were retrieved by means of official statistics. These data were used to explore commonalities in the study population (Kumar, 2012). Amongst others, graphs and tables were utilised to demonstrate cross-national differences in the female uptake of STEM study

programmes in tertiary education among the European Member States. For instance, graphs from the statistical office of the European Union, Eurostat, were used to generate a graph which exclusively shows differences between Sweden and the Netherlands in this matter.

In order to get a better insight on the differences between Sweden and the Netherlands in female participation, the education systems of Sweden and the Netherlands have been examined. Academic sources have been used to describe these systems. These academic sources were retrieved from online reports from organisations such as Nuffic, the organisation for internationalisation of education. Additionally, books and reports from Atria were applicable to the description of education systems. Atria is a Dutch institute for emancipation and women's history, situated in Amsterdam. This organisation houses one of the oldest historical and contemporary collections about women and gender worldwide (Atria, 2013).

The results of the statistics and the description of the education systems seemed to accentuate Sweden's progressiveness concerning the achievement of gender equality. Thus, by using information from academic journals on gender studies and psychology, it has been described why Sweden can serve as a role model for other countries in this matter.

What measures did Sweden take to reduce the gender gap in the STEM fields of higher education?

(Chapter 3)

The third chapter served to highlight Swedish actions in order to increase the number of women participating in the STEM fields of study in higher education. Answering this question contributes to answering the main question since it provides information on how Sweden successfully achieved greater gender equality in its nation and particularly in the STEM fields of study. This question has been answered by using both primary and secondary qualitative data.

Primary data was collected by means of conducting an interview with Kristina Sandström. Sandström is Head of Division of the Engineering and Sciences Department at University West in Trollhättan, situated in Sweden. The research question of the third chapter was taken as a starting point for the interview. However, some information provided by Sandström was also useful to include in the fourth and fifth chapter. The interview questions were specifically targeted at her field of knowledge but also served to gather her personal perceptions on the issues that have been addressed. The interview was held via Skype since Sandström lives in Sweden.

Additionally, secondary data was used to describe how Sweden appears to be successful in maintaining greater gender equality. To explain Sweden's success in this matter, academic sources have been used, such as a Policy Analysis from the Swedish Research Council and the *International Journal of Gender Studies*.

What can the Netherlands learn from Sweden concerning measures to increase female participation in the STEM fields in higher education? (Chapter 4)

The fourth chapter elaborates on what the Netherlands can learn from Sweden concerning measures to reduce the gender gap in the STEM fields of study in tertiary education. The second and third chapter revealed that Sweden is successful in achieving a small gender gap across STEM study fields. Since the Netherlands proved to have a shortage of women in the STEM field, it was important to find out if this country can introduce similar measures to Sweden in their education system to address this issue. National, as well as international policies, were analysed in order to find out if the effectiveness of these policies turned out differently in Sweden and the Netherlands.

The information by the OECD report was particularly useful since it provided information on international policies such as gender mainstreaming, but also national policy measures implemented in Sweden and the Netherlands. Aside from secondary data, primary data was collected by the means of conducting personal, in-depth interviews. The fourth sub-question was utilised as a starting point in both interviews. Yet, both interviews were composed of differing questions that were specifically focused on the position and knowledge of the interviewees, but also their perceptions, beliefs and feelings. The main aim of conducting these interviews was to gain an insight of the different points of views of the respondents concerning female participation in the STEM fields of study, rather than making attempts to establish uniformity in the results of these interviews (Kumar, 2012).

Firstly, an interview was carried out with Noortje Jansen, policy officer at the organisation for Vrouwen in Hoger Technisch Onderwijs (Women in Higher Technical Education), abbreviated as 'VHTO,' situated in Amsterdam. The interview was held via Skype since Jansen temporarily stayed in Japan. Secondly, Doesjka de Jong, employee at the International Office of the Technical University of Delft, participated in an interview that took place at the Faculty of Engineering at the university that is situated in the Netherlands.

How does Dutch culture hold back an increased female participation in the STEM fields of study in higher education? (Chapter 5)

Finally, the last chapter of the research expanded on the negative influence of Dutch culture on the female rate in the STEM fields of study in higher education. It was important to relate cultural factors in Dutch society to the female participation in STEM, as it appeared to be the main reason why the Netherlands are less successful than Sweden in the achievement of greater gender equality across study fields. Qualitative data has been used to explain the shortage of women in STEM in relation with cultural factors. Reliable information was gathered from academic sources such as the report by the CDEG, a Committee for Gender Equality from the Council of Europe (CoE). An academic article from *the Journal of Educational Psychology* that was provided by an employee at the Atria organisation particularly appeared to be an appropriate source that contributed to answering the sub question. In addition, information that was considered to be useful in answering the fifth sub question has been gathered from the interviews conducted with Jansen, De Jong and Sandström.

Based on the findings presented in the five chapters, an answer has been given to the main question of this research: *How has Sweden managed to achieve a smaller gender gap amongst students in the STEM fields of higher education compared to the Netherlands?*

1. Gender gap, stereotypes and higher education

This chapter addresses the question: *"How are gender gap and gender stereotyping defined and how are these concepts expressed in higher education?"* The first part of this chapter focuses on defining the concepts of gender gap and gender stereotyping. The importance of theorising gender gap is directly linked to the research question. In order to find out how Sweden has consistently kept one of the smallest gender gaps in the world in higher education, a clear definition of a gender gap is needed. Furthermore, defining the concept of gender gap is essential since it has been used as a research factor by several organisations and institutions. Before researchers start measuring cross-national differences concerning gender gaps, it is recommended that the researchers are fully aware of the concept of gender gap (WEF, 2014). The results of these organisations are used throughout this research and their concept will, therefore, be examined.

Gender stereotyping is a factor which can result in gender gaps in higher education. Gender gap and gender stereotyping are therefore interconnected with each other. Gender stereotyping will be defined before deliberating on how it is expressed in higher education. Several concepts of gender, gender gap and gender stereotyping will be explored. After doing that, definitions that are most applicable with respect to the role of gender in higher education will be adopted. The second section of this chapter will elaborate on four different studies that demonstrate how gender stereotypes affect study performances and study choices in education and how these stereotypes lead to gender gaps. After that, additional information will be provided by three different European institutions and committees. These associations elaborate on the importance of counteracting gender stereotypes in education in order to reduce gender gaps across fields of study.

1.1 The concept of gender

Before 'gender gap' and 'gender stereotyping' are conceptualised, it is essential to clarify what gender means. Gender stereotyping evolves partly by cause of how gender is understood (Cook & Cusack, 2010). The concept of gender is often mistaken for the definition of sex. Feminist theory states that sex and gender are distinct concepts (Ferber & Nelson, 2009). There is a clear difference between these concepts. Nonetheless, it is difficult to theorise the meaning of gender since there are multiple definitions of the concept of gender. Ferber and Nelson (2009) point out that, "Sex refers to female or male human biological status. Gender refers to behaviours that are linked to practices culturally designated as masculine or feminine" (p. 102). According to the American Psychological Association (APA) (2011), "sex refers to a person's biological status and is typically

categorized as male, female, or intersex. Gender refers to the attitudes, feelings and behaviours that a given culture associates with a person's biological sex."

Both authors imply that gender refers to cultural factors associated with being masculine or feminine. Therefore, both definitions seem to be accurate. Since the term 'gender' is correlated with culture, it is more appropriate than the concept of 'sex' in addressing the issue of gender gaps in this report. Culture is an important factor which contributes to the existence of gender stereotypes. Since cultural tendencies affect students in higher education, the concept of gender is more useful in this report compared with the concept of sex (Cuddy, Crotty, Chong & Norton, 2010).

1.2 The concept of gender gap

Since 2006, the WEF has been releasing yearly Global Gender Gap reports that seek to measure persistent gender inequality on a global level (Lore, 2013). Lore (2013) expresses that, "The Global Gender Gap report is aimed at generating awareness about existing gender inequality and facilitating policies to reduce gaps between men and women." The study by the WEF involves the investigation of the gender gap and its effect on gender equality. The WEF (2014) suggests that gender inequality leads to gender gaps. Thus, it seems that gender gaps are caused by gender inequality and, therefore, prevents the fostering of the accomplishment of reaching gender equality.

1.2.1 Gender gap versus gender equality

Gender gap is perceived as the opposite of gender equality since the gap seems to be a hindrance which prevents countries from reaching full gender equality in the four key areas. The larger the gender gap, the more it hinders societies from achieving gender equality. Accordingly, gender gap could be described as the extent to which gender inequality exists (WEF, 2014). By combining the two terms, the Global Gender Gap Index presented in the Gender Gap Report demonstrates how gender equality and gender gap are interconnected. This index measures gender equality gaps, which is referred to as the extent to which gender inequality is monitored rather than the extent to which gender equality is achieved (WEF, 2014).

In the book *Gender and the European Labour Market* by Bettio, Plantenga and Smith, it is explained how gender gap is related with gender equality. The authors interpret gender equality as the absence of gaps between women and men (Bettio, Plantenga & Smith, 2013). Furthermore,

Plantenga, professor of Economics at the University of Utrecht, supports the assumption that gender gap obstructs gender equality. According to Plantenga (2013), "gender gaps are standardized in such a way that the values indicate the actual distance towards a situation of full gender equality" (p. 45). However, the WEF and the authors Bettio et al. fail to provide a clear definition of gender gap.

1.2.2 Conclusion

Gender gap can have different meanings for different people. For some people, it refers to the observation that men and women tend to differ in their political preferences. For others, it indicates any male-female differences (Barash & Lipton, 2009). Ondercin, assistant professor of Political Science at The University of Mississippi (2007) interprets the gender gap as "a widely-used term to describe any difference between men and women" (Ondercin, 2007, p. 4). This term is considered most accurate and has been adopted in the research. Indeed, gender gap can be used to describe differences between men and women in different areas, such as education. In addition, the theories of Bettio et al. and the WEF contributed to the understanding of gender gap. Both theories support the assumption that gender gap indicates the distance towards a situation of full gender equality (Bettio et al. 2013). Accordingly, in this report, gender gap will be evaluated as a factor which demonstrates the extent to which gender stereotyping is predicted in higher education. By means of a definition of gender stereotypes, it will be easier to understand how this phenomenon affects higher education.

1.3 The concept of gender stereotyping

Gender stereotypes are pervasive in all aspects of life, including education and work. Stereotypes influence behaviours at work and in social life and they are the main causes of inequalities in the labour market (EC, 2015). Begley of News Week (2000) says that, "the power of stereotypes [...] lay in their ability to change the behaviour of the person holding the stereotype" (p. 159). A gender stereotype can be defined by different means but usually, it has a negative influence on the person holding the stereotype. In this report, the negative effects of gender stereotypes on female students in higher education are evaluated. Begley (2000) observes that, "Gender stereotypes are very influential; they affect conceptualizations of women and men and establish social categories for gender. These categories represent what people think, and even when beliefs vary from reality, the beliefs can be very powerful forces in judgments of self and others [...]" (p. 160).

Furthermore, researchers emphasise that gender stereotyping is frequent and the process of it happens unconsciously. Ratliff acknowledges the prevalence of gender stereotyping by citing Brewer (1988), "Researchers suggest that stereotyping, placing individuals into a specific social category based on their membership within a social group, is an automatic process. When encountering an individual, an automatic categorization process takes place" (Ratliff, 2009, p. 5). Ratliff explains that we make judgments about people based on the social groups to which they belong. Then, we decide how closely they fit into the stereotyped group. Basically, perceivers judge people based on the extent to which they feature their social group (Ratliff, 2009). Gender stereotypes should not be mistaken by gender roles.

1.3.1 Stereotypes and gender roles

Gender stereotypes and gender roles tend to be related, but these concepts should not be mistaken by one another (Begley, 2000). Begley (2000) explains the relation between the concepts of gender stereotypes and gender roles as follows:

A gender stereotype consists of beliefs about the psychological traits and characteristics of, as well as the activities appropriate to, men or women. Gender roles are defined by behaviours, but gender stereotypes are beliefs and attitudes about masculinity and femininity. [...] When people associate a pattern of behaviour with either women or men, they may overlook individual variations and exceptions and come to believe that the behaviour is inevitably associated with one gender but not the other. Accordingly, gender roles furnish the material for gender stereotypes. (p. 160)

1.3.2 Stereotype threat

Gender stereotyping can be intimidating to the women and men who are being stereotyped negatively. This is referred to as a stereotype threat. A stereotype threat is a phenomenon that occurs in situations in which the presence of negative stereotypes affects the performance of those to whom the stereotype applies. It seems that people who experience a stereotype threat will be less likely to perform well in higher education or other fields of their interest (Begley, 2000). Begley (2000) endorses this assumption by pointing out that: "A stereotype that pervades the culture the way "ditzy blondes" and "forgetful seniors" makes people painfully aware of how society views them—so painfully aware, in fact, that knowledge of the stereotype can affect how well they do on intellectual and other tasks" (p. 159).

1.3.3 Conclusion

The concept of stereotyping has been examined in the writing of Ratliff, a graduate student in Psychology at the University of Kansas. According to Biernat (cited in Ratliff, 2009), "stereotypes are the general attributes or traits assigned to a particular group of people" (p. 5). These characteristics are associated with the members of this group when stereotyping occurs. Ratliff (2009) explains this 'stereotyping process' by using the following example: "when we see a woman, we place her into the social category "women" and judge her based on the characteristics assigned to women" (p. 5). However, Ratliff's definition of stereotyping does not appear to be suitable for this report since it does not involve the concept of gender.

In contrast, Begley defined the concept of stereotyping in connection with gender. Begley (2000) remarks that, "a gender stereotype consists of beliefs about the psychological traits and characteristics of, as well as the activities appropriate to, men or women" (p. 160). The Steering Committee for Equality between Women and Men (CDEG), an intergovernmental body of the CoE, describes the concept of gender stereotyping differently (CDEG, 2011). The CDEG (2011) defines gender stereotyping as:

preconceived ideas whereby males and females are arbitrarily assigned characteristics and roles determined and limited by their sex. Sex stereotyping can limit the development of the natural talents and abilities of boys and girls, women and men, as well as their educational experiences and life opportunities. (p. 3)

Seeing that the CDEG combines sex stereotyping with defining gender stereotyping, it seems that this committee fails to be capable of distinguishing these concepts. Cook, professor of law, and Cusack, public interest lawyer, define gender stereotyping as an overarching term that refers to a "structured set of beliefs about the personal attributes of women and men" (Cook & Cusack, 2010, p. 20). Furthermore, the authors point out that gender stereotypes are concerned with the social and cultural construction of men and women, due to their different physical, biological, sexual, and social functions (Cook & Cusack, 2010).

Compared with the definitions provided by Begley, Cook & Cusack, the CDEG's definition seems to be least straightforward, since it includes the term 'sex stereotyping.' Involving this term in explaining gender stereotyping might be confusing since the theoretical concept of sex has a

different meaning than the concept of gender. In contrast, Cook & Cusack (2010) seem to be aware of the phenomenon that the way in which gender is understood influences the meaning of gender stereotyping. It is assumed that the authors have a correct understanding of the concept of gender since they elaborate on the social and cultural aspects of this term.

Nonetheless, the definition expressed by Begley seems to be most useful in relation to higher educational settings and, therefore, most applicable to this report. First, the author successfully connected the concept of gender to stereotyping. Second, gender stereotypes among students in higher education are not solely shaped by personal attributes, as claimed by Cook & Cusack, but also by the psychological characteristics and the activities appropriate to them. For instance, studying to become a nurse is considered to be an activity rather than a personal attribute appropriate to a woman (Homan, 2005). The assumption that women are 'warm and caring' could be referred to as a personal characteristic assigned to women that signify why they seem to be likely to choose to study to become a nurse (Begley, 2000). For these reasons, Begley's definition of gender stereotyping seems to be most credible and is therefore adopted in this report.

1.4 Studies on gender stereotypes in education

Gender stereotyping among students tends to occur in educational settings (CDEG, 2011). It is assumed that the stereotypes set upon women and men lead to gender gaps in higher education concerning study choices. In order to find out if this assumption proves to be legitimate, the outcomes of four different studies on gender stereotypes in education are analysed. Several European Union institutions support the results of these studies by confirming that gender stereotyping leads to gender gaps in higher education.

A well-known judgment about females in education is 'girls can't do math' (Begley, 2000). This judgment is a form of gender stereotyping and has a risk of making girls feel insecure about their calculation skills. In addition, stereotypes give female students the assumption that they are not 'smart' enough to excel at math. Thus, it is assumed that they will be less likely to choose for math-related studies in the field of science, technology, engineering and mathematics, referred to as STEM (Case & Huisman, 2015). In this case, gender stereotyping turns into a stereotype threat. The results of two different studies on math performances are described to provide evidence on the assumption that gender stereotyping leads to gender gaps in educational settings.

1.4.1 Study by OECD

The OECD Programme for International Student Assessment (PISA) provided for information on gender equality in education which has been published in the OECD's report (OECD, 2015b). PISA is "a triennial international survey which aims to evaluate education systems worldwide by testing the skills and knowledge of 15-year-old students" (About PISA, n.d). Several surveys have been carried out by this association in order to investigate existing obstacles to gender equality in education. The findings of these surveys demonstrate how self-beliefs, gender and performance in mathematics and science are connected with each other. Convincingly, the results of PISA's surveys give the impression that countries may be unable to develop a sufficient number of students with strong mathematics and science skills, partly because of girls' lack of confidence in their competencies (OECD, 2015b).

PISA carried out two surveys which discussed students' self-belief in different study fields. The first one, PISA 2006, was focused on science, while the second survey, PISA 2012, was targeted on mathematics. According to the OECD (2015b), "self-beliefs influence students' emotional life and they affect the choices students make about coursework, additional classes, and even education and career paths" (p. 68). The first survey, carried out in 2006, contains a questionnaire that entails a large number of questions on students' attitudes towards science. The results of this survey indicate that even among boys and girls who have equal competence in science, girls tend to report lower levels of self-efficacy and self-concept towards this subject. Furthermore, PISA 2006 states that boys had higher self-efficacy and, in particular, a higher level of confidence in devoting themselves to completing specific scientific tasks. These tendencies are noticed among boys and girls across all European Member States (OECD, 2015b).

The findings of this survey signify an intrinsic relationship between science self-efficacy and science performance. The second survey, conducted in 2012, entails a similar questionnaire but was focused on mathematics. Again, girls were less likely than boys to feel 'confident' about their math abilities. The author correctly assumes that insecurity of girls towards science and mathematics is partly caused by external influences. The OECD argues that the learning environment plays an important role in fostering, or undermining, girls' sense of self-confidence. This assumption has been underset by several studies (OECD, 2015b).

1.4.2 Study on high school students in Sweden

Several Dutch studies have shown that stereotype threat has an impact on women's math performance. As previously explained, students who experience a stereotype threat will be less likely to perform well in higher education (Begley, 2000). In Sweden, no study of this phenomenon has been made. However, another survey by Brandell et al. (as cited in Eriksson & Lindholm, 2007) that is considered useful was conducted among Swedish high school students in 2005. This study reveals that in 2005, most students did not have stereotypes of women or men. The students were asked whether the statement 'think math is difficult' applies more to women or men (Eriksson & Lindholm, 2007).

It turned out that only 3% of the students responded 'women, definitely.' Another 25% responded 'women, perhaps.' Male and female respondents showed the same pattern. Simultaneously, the number of women taking college programs or university courses in mathematics has increased in Sweden during the past decade. This phenomenon might be due to the fact that the majority of Swedish students do not seem to have stereotypes about the math abilities of women and men (Eriksson & Lindholm, 2007). Eriksson & Lindholm (2007) point out that, "For instance, compared to women in other countries Swedish may have a stronger sense that they have the same general rights to opportunities and training as men, and such a belief may function as a protection against negative effects of the math stereotype" (p. 330).

Since the Netherlands is considerably less gender equal than Sweden concerning the student participation in the STEM fields, it seems quite plausible that these cultural differences in gender equality have impact on gender stereotype threat effects. The results of the study on gender stereotypes in Sweden turned out positive while comparable studies on Dutch students have shown negative results. These differences may influence the fact that the math and gender stereotype appears less pervasive in Sweden compared to the Netherlands. Yet, there are still differences noticeable in the way Swedes associate mathematics with men and women (Eriksson & Lindholm, 2007).

1.4.3 Study by Radboud University: 2000-2007

A study carried out by Van Langen from the research institute of the Radboud University in Nijmegen, demonstrates that girls do not always make use of their skills to perform well in science

(and science-related) subjects in the Netherlands. The study is based on the study profiles² that girls choose in Dutch secondary education. In the Netherlands, pupils in general secondary education have to opt for a study profile in their third school year which contains a specific combination of subjects. Van Langen investigated data from more than 1600 pupils who were enrolled in their first year of secondary education since 2000. Since then, the pupils have been followed for a couple of years.

The outcomes of this study show that 43 percent of girls do not choose a study profile in 'science and health,' while considering their performances, they could have chosen for the profile 'science and technology.' This is because the former is assumed to be more 'appropriate' for women, especially when they want to specialise in medical and biological fields. The latter is more focused on technical vocational training, including construction, engineering and mathematics.

Furthermore, a significant number of girls tend to opt for a profile in sociology, while a profile in science would also be achievable for them. Only one out in five girls with high grades for the STEM subjects choose for the corresponding study profile, science and technology. Van Langen argues that the fact that girls do not optimally use their talents for STEM subjects is associated with the interests of pupils in specific studies and occupational characteristics. Besides, the advice given by parents and the school underlie the profile choices made by female pupils. Presumably, stereotypical prospects with respect to parents, teachers and counsellors contribute to this (Radboud Universiteit, 2007).

1.4.4 Study by Radboud University: 2007/2008

Van Langen collaborated with Vierke, another researcher connected to the research institute of the University, on another study that concerns the factors that determine if pupils opt for a study profile based on STEM subjects in secondary education. In the school year 2007/2008, the researchers carried out a survey among 7500 Dutch pupils. The results of this study demonstrate the extent to which external influences, namely the school, the parents, the 'peer group,' but also the pupil itself, affect study choices. The peer group refers to the classmates of the pupils. There were two factors which had the most effect on the pupils in deciding what to study. Firstly, their decision depends on the self-confidence of the pupils concerning their ability to succeed in STEM subjects. Secondly, the advice of the pupils' parents affects their profile choices.

² The study profiles in Dutch secondary education are described in chapter 2 (p. 29).

More importantly, it was found that girls are less likely to opt for a science and technology profile than boys. Yet, the chances that boys choose for science and health subjects are less likely than the chances that girls would choose these subjects. This tendency is caused by three different factors. First, girls tend to have less confidence concerning the science and technology profile than boys. Second, they are more likely than boys to get the advice of their parents to choose for the science and health profile. Third, they are less likely than boys to get advised by their parents to opt for science and technology. Thus, there is evidence of the prevalence of gender stereotypes with respect to the way in which the competencies of girls and boys are determined. The male pupils themselves as well as their parents and their class mentors had higher expectations of their capability for the science and technology profile compared with the female pupils who have a similar level of achievement (Van Lange & Vierke, 2009). The contrasting expectations signify that even among the STEM disciplines, a gendered divide exists (Case & Huisman, 2016).

1.4.5 Conclusion

The study by the OECD points out how gender differences in mathematics and science self-efficacy and self-concept remain large, even among students who perform at the same level in mathematics and science. Girls whose performances are equivalent to those of the boys reported much lower levels of mathematics and science self-efficacy and lower levels of mathematics and science self-concept. This gender imbalance concerning self-efficacy and self-concept appears to be an important issue since the OECD affirms that girls rate their own capabilities to perform well in mathematics and science as lower than that of boys already in the first year of primary school. This even occurs when their performance does not differentiate with that of boys. The OECD says that self-concepts of students tend to be shaped by external influences. In turn, students' self-concepts affects their performances in their particular field of study. Subsequently, their overall attitude towards mathematics and science plays a big role in deciding what to study (OECD, 2015b).

Several Dutch studies have shown that stereotype threats have impact on women's math performance. In Sweden, no study of this phenomenon has been made. Another survey on gender stereotypes was conducted among high school students in Sweden in 2005 reveals that most of these students did not hold gender stereotyped views towards mathematics. The majority of these students were neutral about the statement 'think math is difficult.' In response to the results of this survey, Eriksson and Lindholm (2007) argue that the cultural emphasis on gender equality in Scandinavia might have led to a weakening of the gender stereotypes. Furthermore, the authors

correlate the fact that Sweden has one of the smallest gender gaps in the world with the results of the survey. This small gender gap is related with the Swedish high norms of gender equality. For this reason, Eriksson and Lindholm allow for the idea that cultural factors concerning gender equality have impact on the extent to which gender stereotyping exists in education (Eriksson & Lindholm, 2007).

The two studies that were carried out by the research department of the Radboud University focused on how gender stereotypes affect students' decisions on what to study. By comparing these two studies, it turns out that external influences affect the profile choices of pupils in secondary education. In the first study, it was assumed that stereotypes contribute to the fact that a high amount of girls with high potential to succeed in STEM subjects still opt for a study profile which is not (entirely) related to their competencies.

The second study affirms this assumption by pointing out the most profound factors affecting the choices of girls. Stereotypes turned out to be the most influential, as girls were less confident about their competencies concerning science and technology than boys. At the same time, their choices were affected by the advice of their parents. Both studies have been conducted in secondary education.

Finally, the outcomes of these studies are related with stereotyping towards students in higher education. Study profiles in secondary education connect to higher education since study choices of pupils are often bound by their profile subjects (Onderwijsraad, 2011). Study choices made in secondary education that are influenced by gender stereotypes continue to exist in higher education. As a result, gender stereotypes remain prevalent in higher education (European Council, 2015).

1.5 Support by European institutions

The previously described studies contribute to the validity of the assumption that gender stereotypes are pervasive in educational settings (EC, 2015). The stance of several European institutions on the effects of gender stereotypes validates this assumption.

1.5.1 European Commission

Gender stereotypes tend to contribute to gendered segregation across study fields in higher education (European Council, 2015). For instance, the STEM subjects are recognised as 'boys'

subjects. The EC (2009) admits that in higher education, “boys predominantly make their way towards scientific, technical and industrial fields from which it is generally easier to find a place in the labour market. This signals a gender pattern of study choice that needs to be addressed by treating both sexes equally” (p. 39). The information provided by the EC seems to support the outcomes of the Radboud research on how external factors affect students in deciding what to study. According to the EC (2009):

The reasons why study field choices are gendered include stereotypes often found in children’s books and school manuals; gender attitudes of teachers, gendered advice and guidance on courses to be followed; different parental expectations regarding the future of girls and boys; and so forth. (p. 39).

Accordingly, the EC’s Directorate-General for Employment, Social Affairs and Equal Opportunities states that, “often traditions and stereotypes affect the careers of women and men through influencing their choice of educational paths” (Fight against gender, 2010). In high school, gender stereotypes cause the presumption that STEM subjects are for boys, which leads to fewer women taking STEM subjects in secondary education. This results in scattering numbers of female graduates and fewer women working in these fields. Gender stereotypes, therefore, cause segregation in the labour market. Even though the majority of university graduates in the EU are women, they continue to work in jobs and sectors which are often lower valued and lower paid than those dominated by men (Fight against gender, 2010).

1.5.2 European Trade Union Committee for Education

The European Trade Union Committee for Education (ETUCE) aims to counter gender stereotypes in education. ETUCE is the teachers' social partner at European level and a defender of teachers' interests to the European Commission (ETUCE, n.d). The committee claims that education is a human right and states that gender stereotypes restrict opportunities in the lives of women and men. ETUCE (2012) notes that, “traditional perceptions of gender roles and gender stereotyping influence individual decision-making in many important aspects of life” (p. 10). Gender stereotypes tend to be deeply entrenched in society. The education system plays a significant role in this. The social construction of gender appears at all educational levels; from pre-school to higher education. The gender segregation in education can be explained by the fact that education systems reflect the traditions and culture of its society. This tendency leads to study choices that reflect stereotypical perceptions of women and men (ETUCE, 2012).

1.5.3 Steering Committee for Equality between Women and Men

The CDEG believes that gender stereotypes influence pupils' study choices. In most European countries in 2009, over 50 percent of students in higher education were female. Nonetheless, they constituted on average between 15 and 20 percent of the total numbers studying engineering, manufacturing and construction. In addition, women constituted between 30 and 40 percent of the total numbers studying science, mathematics and computing.

As described in the section on the study reported in OECD by PISA, performances of girls and boys in both science and mathematics are affected by their self-concept towards this subject. This phenomenon occurs across all European countries. The outcomes of the PISA 2006 survey are described in the CDEG report as well. By using the results of this study, the CDEG emphasises that much has to be undertaken in the pursuance of reaching gender equality in education (CDEG, 2011).

Beneficial to the increase of the number of women participating in STEM subjects, the CDEG promotes changes in the educational system. The Committee claims that schools are not dedicated enough to encourage their pupils to make non-traditional choices. The Committee accentuates its objectives by demonstrating the results of a survey carried out by the CoE. The outcomes of the study reveal that only half of the European countries announced that schools in their respective country are either required or encouraged to increase the number of girls taking science and technology subjects in secondary education (CDEG, 2011).

1.5.4 Conclusion

The EC, the CDEG and the ETUCE confirm that gender stereotypes are pervasive in educational settings. First, the EC describes how these stereotypes eventually lead to segregation in the labour market. Second, the ETUCE argues that gender stereotypes are deeply rooted in society, including education settings. Third, the CDEG elaborates on how the disparity between women and men concerning their enrolment in STEM-related courses is evident in all European countries.

In conclusion, gender gap and gender stereotyping tend to be related since gender stereotyping leads to gender gaps. Gender stereotyping is prevalent in higher education and leads to gender segregation in study programmes in higher education. Several studies on the influence of gender stereotyping on girls and boys in education together with the information provided by European institutions on this issue support this assumption. It should be taken into consideration that the

gender gaps in differentiates between European countries. Herweijer, a researcher from the Dutch Social and Cultural Platform (SCP), noticed contrasting percentages across several European countries in this matter (Homan, 2005). In the next chapter, the differences between Swedish and Dutch female students in higher education concerning their participation rates in STEM courses are examined.

2. Female participation in the STEM field in Sweden and the Netherlands

The tertiary uptake of females in STEM study programmes across Sweden and the Netherlands is examined in this section (Bennett, Braund & Sharpe, 2013). The data is based on the outcomes of the number of women in 'male studies,' since the difference between the male and female students' choice of subjects such as science and engineering as a major appears to be significant. Accordingly, the disparity between women and men appeared to be the largest in the STEM field in higher education across European Member States (Case & Huisman, 2015). In this chapter, the differences observed between Sweden and the Netherlands regarding gender gaps across study programmes in the STEM fields are reviewed, so that an answer can be given to the following question: *"What differences are to be observed between Sweden and the Netherlands concerning the gender gap in the STEM fields of higher education?"*

2.1 Earlier results

The Netherlands has had a poor reputation regarding the interest of students in studies in the field of STEM for a long time. Already before 1999, the interest of girls in STEM studies was minimal in the Netherlands (Reijn, 2005). In the EU, there was only one country in which there were fewer women who opted for a study in the STEM field in 2001, namely Switzerland. In the field of mathematics, the Netherlands had the worst reputation of all EU Member States. In Sweden, double as many students compared to the Netherlands had chosen a study programme in the STEM field in this year. Simultaneously, the percentage of women that chooses to study in this area was double the number of the Netherlands in Sweden (Reijn, 2005).

Moreover, a statistic on male and female college graduates and their fields of study for 84 countries in the period between 2005 and 2008 has been published by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) in 2010. This statistic reveals that the female representation in the science fields of study was lowest in the Netherlands in that period of time (EIGE, 2013).

2.1.1 Earlier results from a study by Eurostat

The statistical office of the European Union, Eurostat, generated an international comparative analysis of the registered students in tertiary education in 2009. In science, mathematics and computing studies, the Netherlands scored lowest with a participation rate of 19%, compared to all the other European countries. When looking at the participation rate of women in engineering,

manufacturing and construction, they are ranked almost lowest with a rate of 16%. Only Switzerland and Ireland were ranked lower (Booy, Jansen, Joukes & Van Schaik, 2011). When these numbers are compared to the EU-average, Sweden exceeded this percentage while the Netherlands were clearly underperforming.

Table 1. Percentage of women in tertiary education in STEM in 2009

	<i>Engineering, manufacturing and construction</i>	<i>Science, mathematics and computing</i>
Sweden	29	43
Netherlands	16	19
EU-27	25	38

Source: Eurostat, 2009.

In addition, the outcomes of the statistic published by Eurostat the year after, in 2010, proved to be similar to the one from 2009 (EIGE, 2013). As explained in the previous chapter, the strikingly low participation of Dutch women in higher education in the STEM fields might be due to the remarkably low self-image of Dutch girls towards science compared to boys. This low self-image is notable because the performances of these girls in science subjects are almost similar to those of the boys. The low self-esteem can be associated with the fact that the Dutch score high regarding their association with gender stereotypes. The high rate of gender stereotyping in Dutch culture, therefore, leads to the low participation of Dutch women in STEM (Booy et al. 2011).

2.1.2 Earlier results from PISA

In the previous chapter, gender stereotypes proved to have considerable influence on the self-concept of boys and girls concerning their competencies in STEM subjects. A table was generated to demonstrate the contrasting results of Sweden and the Netherlands concerning the gap between male and female pupils' beliefs in their own mathematics abilities across the OECD countries. The information derives from a research carried out by the PISA in 2003 (OECD, 2014). This research has been conducted among pupils of the age 15 in high school instead of students in higher education. Nonetheless, the outcomes of this research appear to be useful for this report, since gender segregation in secondary education often continuous to occur in tertiary education (Van Langen, 2005). In PISA 2003, each index is scaled as follows: the higher the index number, the larger the difference between boys and girls. A ranking of number 0 would signify that there is no

segregation between boys and girls concerning their self-concept towards mathematics (OECD, 2014).

Table 2. Index self-concept boys / girls in mathematics in OECD and partner countries 2003

<i>Country</i>	<i>Index</i>
Netherlands	0.55
Sweden	0.35

Source: PISA, 2004.

The Netherlands scored a number of 0.55 while Sweden was ranked lower with an index of 0.35. The Netherlands proved to have a very high index compared to the other OECD countries; only in Germany, Switzerland and Liechtenstein, the index was higher in 2003. Evidently, the outcomes of the index demonstrate that Dutch boys and girls tend to have a more divergent self-image concerning their capabilities to succeed in math compared to Sweden. According to Booy et al (2011), the considerably low self-image of girls in this matter is directly linked to the fact that Dutch citizens score high concerning the association of stereotypes compared to citizens of several other EU Member States. Nonetheless, there is not one OECD country, not even Sweden, which shows a contrasting result of girls being more confident about their mathematics abilities instead of boys. Accordingly, Swedish boys still have a more favourable self-concept in math compared to Swedish girls (PISA, 2004).

2.1.3 The development of female participation in the field of STEM education

The studies previously described show that there has been a shortage of women in tertiary education in the STEM fields for a long time in the Netherlands. Simultaneously, Sweden appeared to be relatively successful in achieving greater gender equality in this field. Moreover, it is found that the Netherlands has a large gender gap concerning the self-concept of pupils in mathematics compared to Sweden. Booy et al (2011) claim that the gender imbalance in the Netherlands in this matter is induced by gender stereotypes.

In order to compare Sweden with the Netherlands, three additional studies are used to present recent developments of the female participation in the STEM field. By using the results of these studies, the participation of women in degree programmes in the STEM field in Sweden is compared with the Netherlands. Additionally, the averages of the outcomes of the other countries included

in these studies are examined to find out the position of Sweden and the Netherlands in relation to this average.

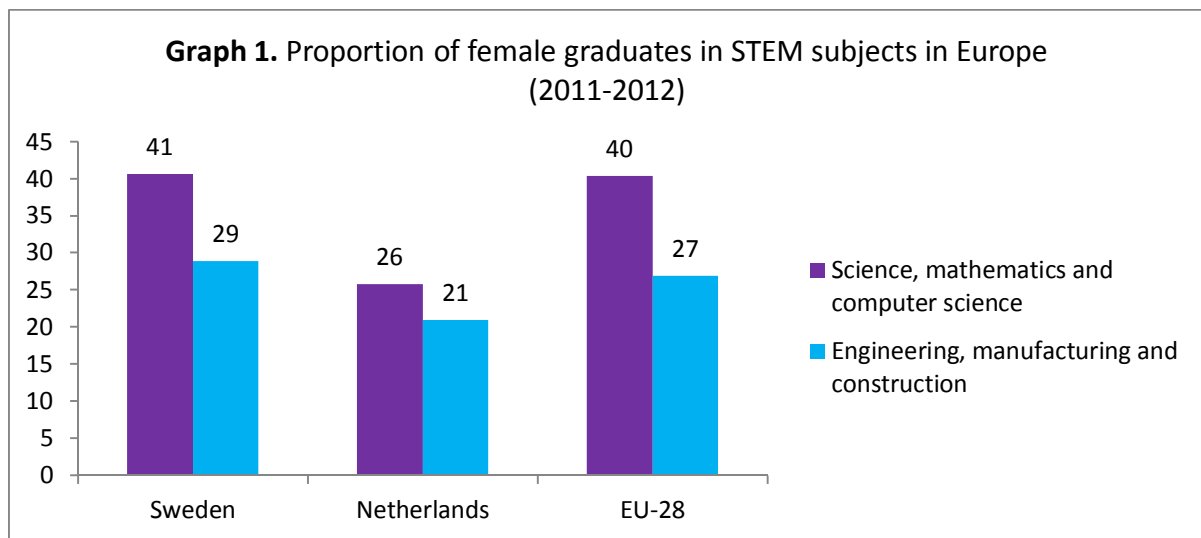
Information from the 28 European Union Member States has been gathered through the first two studies. The third study was carried out by the OECD. Data have been obtained from the 34 OECD member countries, including Sweden and the Netherlands, for the third study described below (OECD, n.d). The results of the three studies demonstrate the number of female students and/or graduates in STEM subjects in higher education.

2.2 Eurostat: proportion of female graduates in the STEM field

The first research is carried out by Eurostat in all 28 countries of the European Union. The research population concerns female graduates in higher education in a given year of study, in this case, 2011-2012. By using the information from Eurostat, a coherent table was composed to point out how the results of Sweden and the Netherlands differentiate from each other, but also how they differentiate from the EU average (Aandeel gediplomeerde vrouwen, n.d).

In graph 1, presented below, the proportion of female graduates in STEM fields is divided into separate fields. The first field comprises science, mathematics and computer science and the second field involves engineering, manufacturing and construction. In the Netherlands, there are few women in both fields of study. Especially in the field of sciences, mathematics and computing, the Netherlands lag behind the rest of the European Member States. With respect to the proportion of female graduates in science, mathematics and computer science, Sweden slightly outperformed on the results of the EU average taken by the 28 countries of the European Union.

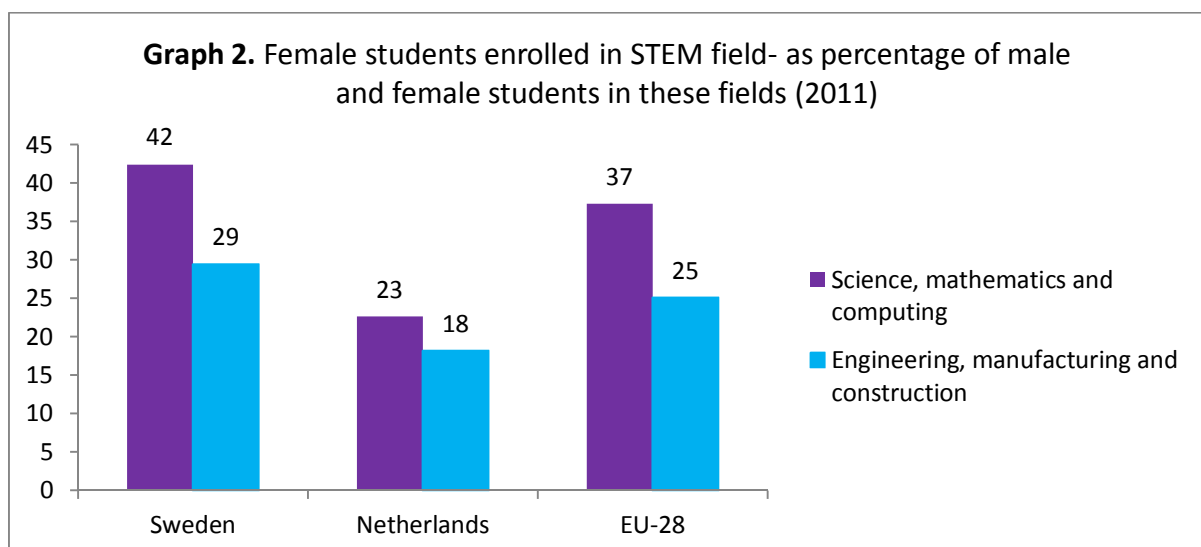
The rate of Dutch female graduates was lower than the number of female graduates in this field of study in Sweden as well as the EU average. In the fields of study of engineering, manufacturing and construction, it is noticed that Sweden again outperformed the Netherlands and the EU average concerning their share of female graduates. The Netherlands are lagging behind with a share of 21 percent female graduates in this field (Aandeel gediplomeerde vrouwen, n.d).



Source: CBS-Eurostat

2.3 Eurostat: female students enrolled in the field of STEM

Another research carried out by Eurostat indicates the share of women amongst tertiary students, divided by enrolments of women in science, mathematics and computing and enrolments of women in engineering, manufacturing and construction. In this study, Eurostat refers to students in tertiary education as 'tertiary students'. Eurostat counts universities of applied sciences, universities, education from the Open University (exam programmes) and other, mostly private, vocational education on this level as tertiary education (Booy et al. 2011). This research concerns a different focus group, since it concerns the enrolment of female students in STEM subjects instead of the percentage of female graduates in STEM subjects (Merens & Van den Brakel, 2014).



Source: Eurostat, 2011

Even though more women in the Netherlands are enrolled in higher education compared with men, traditionally few women choose to study in the STEM field. Despite a small increase in the Netherlands, few Dutch women participate in this field of study, compared with other EU countries. In the field of science, mathematics and computing, the share of women in 2011 of not even 23 percent (the percentages are round up) was the lowest in the EU. Accordingly, the number of Swedish women in this field is almost double as high as the number of Dutch women. In the field of engineering, manufacturing and construction, Dutch women ranked low with a percentage of 18 percent. Only Luxembourg and Ireland scored lower. Even though there is an increase of Dutch women in higher education in general, they are underrepresented in STEM studies. (Merens & Van den Brakel, 2014).

Another study was conducted by the Dutch central statistical office (CBS) in the year 2013/2014 amongst students in tertiary education in the Netherlands. This study demonstrates the percentages of women in study programmes in the field of science and technology (S&T) in higher education in proportion to the number of female students in higher education in general. Higher education in the Netherlands includes students from universities of applied sciences and traditional research universities (Van Langen, 2005). The study proved that women indeed dominate higher education but not the STEM fields (Merens & Van den Brakel, 2014). Accordingly, the study shows how gender segregation occurs in the STEM fields of study rather than the enrolments in higher education.

Table 3. Number of women in the S&T fields of study in percentages (year 2013/2014)

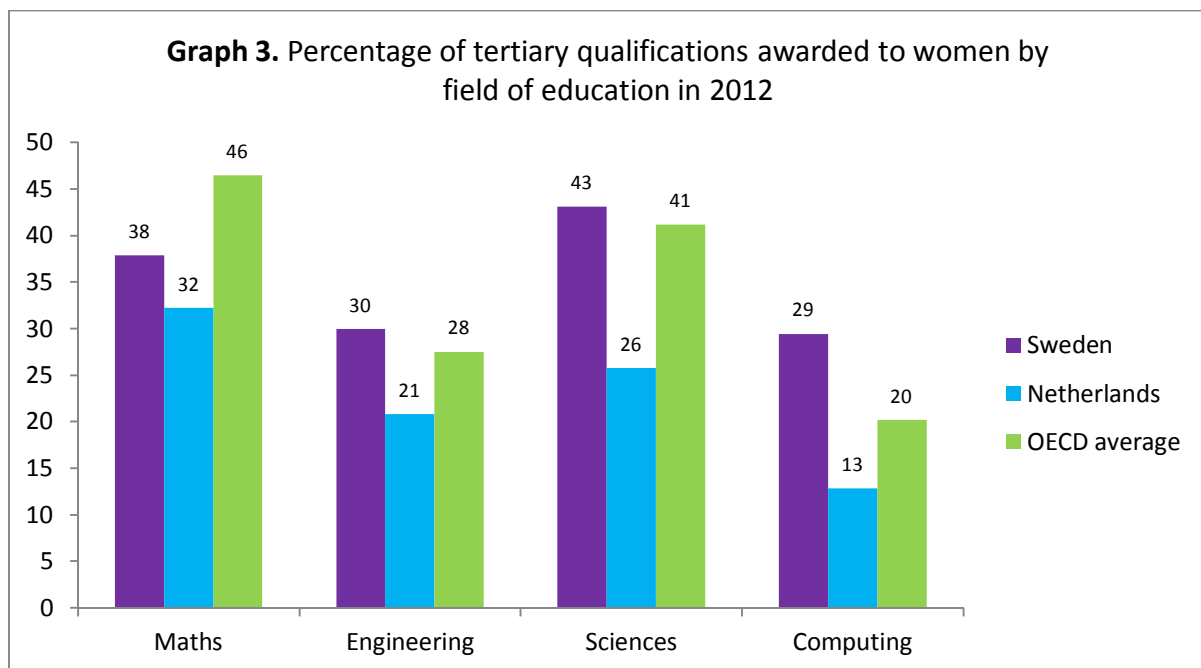
	<i>Total number</i>	<i>Science and technology</i>
HBO	53	20
WO	53	26

Source: CBS, 2014

2.4 OECD: tertiary qualifications awarded to women

A corresponding study to the two previously discussed studies was carried out by the OECD. This organisation uses its "wealth of information on a broad range of topics to help governments foster prosperity and fight poverty through economic growth and financial stability" (OECD, n.d). The study was conducted by estimating the percentage of tertiary qualifications awarded to women by field of education, which could also be referred to as the percentage of female graduates. The fields

of study mathematics, engineering, science and computing have been included in the following table (OECD, 2014). Computing belongs to the STEM fields of study since it is part of a technology degree programme (What is computer, n.d). In all fields of study in STEM, Sweden has a higher representation of female graduates compared to the Netherlands. The gender gap in the fields of computing and engineering, in particular, proved to be notably large in the Netherlands. In Sweden, the percentage of female graduates in computing is almost double as high. Remarkably, this percentage exceeds the OECD average (OECD, 2014).



Source: OECD, 2014

2.5 Analysis of the results

The outcomes of the three studies show that compared with the EU average and the OECD average, the participation rate of Dutch women in STEM studies is considerably low. The factsheet on women in science, composed by Dutch feminist institute Atria, supports these outcomes. The factsheet demonstrates that compared to other European countries, the Netherlands lag behind in terms of participation of women in STEM courses. The Netherlands is in the lowest regions in higher technical studies, apart from Ireland. In the science and ICT degree programmes, the Netherlands occupied the lowest place in 2012 (Atria, 2015a). Charles (2011) describes the outcomes of a comparison of the gender ratio of science graduates to the gender ratio among graduates in all other fields. It turned out that female presentation in science programs is weakest

in the Netherlands. Charles (2011) reveals that, "Although the Netherlands has long been considered a gender-traditional society in the European context, most people would still be intrigued to learn that women's representation among science graduates is nearly 50 percentage points lower there than in many Muslim countries" (p. 24).

However, the amount of women in STEM study programmes in Sweden is not exceedingly high compared to the average numbers. For instance, they still underperform in comparison to the OECD average in mathematics. Furthermore, in the first study, Sweden's numbers only slightly exceeded those of the EU average. Even though female representation in science programs is weakest in the Netherlands, it is not strongest in Sweden. The female representation in science programs is strongest in Muslim countries such as Iran, Uzbekistan and Saudi Arabia. Nonetheless, Sweden seems to be successful in maintaining a reasonable number of women in these 'male studies,' especially in comparison to the representation of Dutch women in these fields (Charles, 2011). The successfulness of Sweden in this matter might be partly derived from the effective implementation of their education system. In the next section, the education systems of Sweden and the Netherlands are analysed.

2.6 Education systems

It should be taken into consideration that the education systems of the countries in the European Union have different structures. Apart from gender stereotypes, education systems might also affect the students in deciding what study to choose (Social Cultural Platform (SCP), 2000). The Atria institute supports this assumption. Atria argues that there is an early selection of students in secondary education in the Netherlands compared to Sweden (Atria, 2015b). In pursuance of comparing the Swedish and Dutch education systems, it is important to gain information about the structure of the education systems in these countries.

2.6.1 The Dutch education system

Dutch secondary education (also referred to as high school) includes HAVO, which could be described as senior general secondary education. HAVO prepares pupils for the university of applied sciences. VWO could be referred to as pre-university secondary education, which prepares pupils for university. Lastly, there is VMBO, which is described as pre-vocational secondary education (Van Langen, 2005). The uptake of VMBO pupils in STEM courses is not discussed in this report because these pupils do not make the transition to higher educational institutions such as universities. Thus, the focus lies on the HAVO and VWO pupils in secondary education.

Nowadays, Dutch pupils in secondary education choose their subjects for final examination purposes (Van Langen, 2005). As explained before, the participation of girls in STEM courses has been low for a long time in the Netherlands. However, the situation got worse onwards 1999, during the implementation of two different science 'study profiles' (Reijn, 2005). Around the age of 14, pupils must choose one of four so-called 'study profiles' with a unique combination of subjects each. The four study profiles are as follows: culture and society, economics and society, science and health and science and technology (Van Langen, 2005). Subsequently, students from HAVO and VWO have the possibility to apply for a study programme in tertiary education (higher education). Van Langen (2005) explains that:

Higher tertiary education in the Netherlands consists of a university education (WO, wetenschappelijk onderwijs), or a higher professional education (HBO, hoger beroepsonderwijs). Pupils with a secondary education VWO diploma are, in principle, given direct access to both HBO and VWO in the Netherlands while pupils with a HAVO diploma only have access to HBO. (p. 4)

The Dutch education system may contribute to the low participation in STEM in the Netherlands. Research shows that the lack of girls who opt for STEM subjects in the Netherlands could partly be derived from their ignorance regarding the several advantages of choosing a study in the field of STEM (Atria, 2015b). A lot of girls in secondary education are not being stimulated enough by their teachers and counsellors to find out what the STEM subjects could offer them. For instance, many girls do not know how broad and various the choices are in the STEM fields of study (Booy & Joukes, 2004).

Before 1999, 9 percent of girls in HAVO chose the STEM study profile 'science and technology'. In 2001, the share of girls in science and technology was only 2 percent. The same problem arises in VWO, where the participation of girls in this specific study profile stigmatised from 30 percent in 1999 to 2 percent in 2001. Another factor which causes these differences is the number of 'intake moments' in the STEM fields of subjects. In the Netherlands, these study profiles compose of either 'science and technology' or 'science and health.' A Dutch student who has chosen subjects in the STEM field in high school is almost 'tied to' study programmes such as mathematics, physics or chemistry. This is not the case in Sweden (Reijn, 2005).

2.6.2 The Swedish education system

In Sweden, primary education comprises primary school and lower secondary school, which lasts 9 years. Senior secondary education is comparable to the Dutch upper secondary school, which is called 'gymnasia' in Sweden. Pupils from the age of 16 to 19 in gymnasia follow a basic curriculum of six core subjects including maths and science, which are mostly focused on preparing for a study programme in higher education. In addition, they can choose from twelve remaining national programmes or they can opt for an individually formulated course of study (Van Langen, 2005). In 1993, Swedish pupils received the freedom to compose their own curriculum which became more determined by their desired study programme in higher education. This change was made possible by the creation of the new Higher Education Act and Higher Education Ordinance of Sweden (Nuffic, 2014).

The Swedish Agency for Higher Education (Swedish translation: Högskoleverket) states that Swedish pupils go to higher education at the age of 19, which is divided into undergraduate studies (courses combined towards a first degree) and postgraduate studies and research. When they make the transition to higher education, students can combine their own courses into a degree programme. There is scope for individual choice but students may combine different courses into a degree programme (Högskoleverket, 2005).

Most students who apply for a study programme in the STEM field have completed the natural science programme in upper secondary education. For the students who did not enrol for this science programme, the Swedish government funded options which provide new opportunities to participate in the STEM fields of study in higher education. For instance, various universities introduced a preparatory year that students can follow after which they are guaranteed a place in university in the field of STEM of their preference (Van Langen, 2005). More information on this pre-university year is provided in the next chapter.

2.6.3 Differences between the Swedish and Dutch education system

The differences between the education systems of Sweden and the Netherlands seem to have influence on the divergence between these countries concerning the gender gap in STEM in higher education. Van Langen (2005) suggests that the Netherlands has much to learn from Sweden (cited in Reijn, 2005). The differences between Swedish and Dutch students in deciding what to study could partly be caused by the fact that in Sweden, the science disciplines in higher educational studies are much wider than in the Netherlands (Reijn, 2005). Van Langen (2005) mentions that in

Sweden (cited in Reijn, 2005), "Half of the bachelor programme covers your major, the other half consists of other subjects. Apparently that's more attractive".

Thus, in , there are more broad and interdisciplinary STEM courses in the degree programme. In the Netherlands, STEM study programmes are highly compartmentalised and more specialised on a specific subject. Moreover, for the Swedish students, there are possibilities for new intakes in the STEM route at various points. In the Netherlands, the intake for the STEM track already starts in upper secondary education (Van Langen, 2005). Van Langen (2005) suggests that these aspects of the Dutch education system make STEM higher education unattractive for many potential STEM students. Since Sweden has a higher rate of women in STEM combined with a wider variety of possibilities to enter STEM courses in higher education, this Nordic country seems to be a role model for the Dutch education system. In furtherance of explaining the differences between Sweden and the Netherlands in this matter, the next section elaborates on the assumption of Sweden as a role model.

2.7 Sweden as a role model

The Swedish model is perceived as progressive in terms of feminist policies and might even be considered to be a 'woman-friendly state' (Lewis & Åström, 1992). In Sweden, there is a lot of interest in and support for gender studies. This is partly because gender studies are seen as valuable in fostering gender equality in higher education (Bencivenga, Stoltz, Jacobsen, & Fahlgren, 2015). Sweden's 'gender-neutral' pre-school is described as an example of the extent to which Sweden takes gender issues seriously. The school is called 'Egalia,' which is translated as 'equality.' Egalia's core mission is "to treat gender like most schools treat race or religion - as a trait that stands outside students' actual character and, therefore, isn't something that needs to be discussed at school" (Weller, 2015).

According to Hebblethwaite (2011), "The teachers avoid using the pronouns "him" and "her" when they talk to children. Instead they refer to them as "friends", by their first names or as "hen," a genderless pronoun borrowed from Finnish." Furthermore, the author declares that "gender advisers are now common in schools, and it is part of the national curriculum to work against discrimination of all kinds" (Hebblethwaite, 2011). In the Netherlands, gender-equal pre-schools such as Egalia have not been introduced in the education system (yet).

In the Swedish government, maintaining greater gender equality in higher education is considered necessary. The fact that gender equality has been part of their legislation for a long time could be related to their culture. Eriksson and Lindholm (2007) assume that the cultural emphasis on gender equality in Sweden may have led to a weakening of gender stereotypes in higher education. Swedish women may have a stronger sense that they have the same general rights to opportunities and training as men. As an example, such belief may function as a protection against negative effects of the math stereotype that was discussed in the previous chapter (Eriksson & Lindholm, 2007). Convincingly, Sweden seems to make significant progress in effectively reducing gender stereotypes among all educational levels. Since gender stereotyping is prevailing in the Dutch education system, Sweden is considered as a role model for reducing these gender-traditional perceptions.

2.8 Conclusion

In conclusion, there is a higher percentage of women in STEM studies in Sweden compared to the Netherlands. The participation rate of women in STEM studies in the Netherlands is one of the lowest in the world. The low participation of Dutch women in STEM studies has been presented in the data by Eurostat and the OECD. The weak presence of women in STEM fields in the Netherlands appears to be due to institutional and cultural factors. It was affirmed in the previous chapter that gender stereotyping is a cultural factor that leads to gender segregation in higher education. Amongst others, gender segregation exemplifies the uneven distributions of women and men across fields of study (Charles, 2011). The impact of gender stereotypes contributes to the low participation of women in STEM (European Council, 2015). According to the EC, traditional stereotypes remain the biggest challenge for gender equality in education (EC, 2010).

Due to the low representation of women in STEM, several countries conduct gender equality policies in higher education (EC, 2010). The differences in educational systems in Sweden and the Netherlands are partly responsible for these outcomes. Furthermore, the Swedish government contributes to maintaining gender equality in higher education. The Swedish model is, therefore, assumed to be a role model for the Netherlands concerning their considerably high female participation rates in studies in the STEM field. In order to support this assumption, initiatives taken by the Swedish government are examined in the next chapter. In doing so, the ways in which these initiatives contribute to reaching gender equality in the STEM fields of higher education are ascertained.

3. Measures that were taken by Sweden to reduce the gender gap

Swedish policy makers took many profound initiatives in order to counter gender stereotypes and reach equality in higher education (Bencivenga et al. 2015). These initiatives contributed to Sweden's success in achieving gender equality in higher education. According to the SCP (2000), the rate of women in STEM in tertiary education is relatively high in Sweden. After these measures are analysed, the possibility to take similar measures in the Dutch education system can be ascertained. An overview of the most important initiatives that have been taken by Sweden to increase gender equality in higher education is provided in this chapter to answer the question: *"What measures did Sweden take to reduce the gender gap in the STEM fields of higher education?"*

3.1 History of measures in gender equality in Sweden

It appears to be necessary to first explain how Swedish policy actions toward greater gender equality in society evolved in the past decades to understand how this country achieved a small gender gap in the STEM fields of higher education. Already in the 1890s, the first steps toward the construction of the Swedish welfare state were taken by Swedish policy makers (Tepe, 2005). Likewise, many European countries attempted to develop social democratic systems after 1911. However, most of these countries were dominated by extremist challenges and political and class divisions due to the industrialisation in Europe at that time. In contrast, Sweden escaped this invasion since socialist leaders already got considerable recognition and support from the public in the early stages of Swedish industrialisation.³ Swedish social democrats were early in effectively counteracting the impact of challenges of industrialisation on Swedish social, political and economic structures (Ahn, 1996). Subsequently, the social democratic parties appeared to influence the creation of a democracy positively. In doing so, these parties highly valued gender equality on their political agenda (Tepe, 2005).

In 1921, Sweden successfully became a full democracy in which the equal voting rights for women and men were introduced. The Swedish government put an end to the joint taxation and replaced it with individual taxation in 1970 (EC, n.d). According to the EC (n.d), "These two policy decisions had a considerable impact on gender equality but also other political reforms regarding social insurance system, improvements in education, health and care sectors have contributed" (p. 1). These political reforms were stimulated by the social democratic Swedish welfare state or 'the

³ Industrialisation in Sweden took place from 1910 to 1939 (Ahn, 1996).

Swedish Model.’ These political actions appeared to be particularly successful after the 1960s. Since then, the Swedish model has provided Sweden international reputation as one of the most generous welfare states of the world (Tepe, 2005).

When looking at political reforms, gender studies particularly contributed to reaching greater gender equality regarding the STEM fields of education in Sweden. At the end of the 1970s, gender research associations were implemented at the largest universities. Since the establishment of the gender associations, the Swedish government made efforts to maintain gender equality nationally. During the 1990s, there was considerable progress in the measures that were taken to promote women specifically in higher education. In that time, two bills, Equality between women and men (Jämställdhet mellan kvinnor och män 1994/95:164) and Science and Society (Forskning och samhälle 1996/97:5) were implemented by the governmental policies for equality.

The first bill, introduced in 1995, stimulated Swedish research councils to take equality between women and men into account in the scientific areas of education. The second bill ensured that since 1997, the universities are in charge of attaining more gender equality in disciplines where gender is unevenly represented, such as science and technology. The EC explains that these bills were not only aimed at increasing the numbers of women across different fields of study in universities, but they also contributed to raising more awareness about gender equality in general (EC, n.d).

Today, gender research continues to include research in technology and natural sciences. The government and the legislation encourage these actions. In Sweden, gender studies and research are perceived as valuable in fostering gender equality in higher education but also in society in general. Partly for this reason, Bencivenga et al. (2015) consider Sweden to be a role model for gender equality in education but also in other areas.

3.2 Measures for gender equality in higher education

3.2.1 Equality as a priority in the Swedish national curriculum

Sweden has an education system where the curriculum has been reformulated in a gender egalitarian manner. In this curriculum, equality between men and women in education is prioritised. As stated in Blumberg (2008), “the school should actively and consciously further equal rights and opportunities for men and women” (p. 32). Schools in Sweden have the responsibility to counteract traditional gender roles. According to Blumberg (2008), “the curriculum advises that

everybody who works in the school should “work against any restrictions on the pupil’s choice of study or vocation that are based on gender” (p. 32). Teachers and study advisors should not express stereotypical views towards their preferences in study programmes (Blumberg, 2008). As explained in chapter 1, studies of the STEM fields of study have shown school factors- including teachers advice- to play a role (Van Langen, 2005). Accordingly, making teachers and study advisors aware of gender stereotyping seems to be an effective initiative to counter gender inequality.

3.2.2 Gender mainstreaming

A strategy which appears to be effective on a European level in achieving greater gender equality is ‘gender mainstreaming.’ Gender mainstreaming is a political strategy implemented by all the EU Member States since the Beijing Declaration of the United Nations (UN) in 1995 (Porter & Sweetman, 2005). The political agenda of this declaration “aims at removing the obstacles to women’s active participation in all spheres of public and private life through a full and equal share in economic, social, cultural and political decision-making” (United Nations, n.d). The UN Economic and Social Council (as cited in Porter and Sweetman, 2005) define gender mainstreaming as follows: “the process of assessing the implications for women and men of any planned action, including legislation, policies or programmes, in all areas and at all levels” (p. 2).

The Beijing Platform for Action is involved in the encouragement of women to participate in STEM, which is included in a section on the education of women. One of the objectives outlined in this section is to improve women’s access to science and technology. Moreover, the Platform aims to counter discrimination in education sources such as gender-biased science curricula and texts. In addition, the Commonwealth Plan of Action on Gender and Development (1995) recommends several measures to include more women in science and technology, such as programmes directed at women to strengthen their self-esteem and the encouragement of gender-inclusive curricula which might lead to more women in these fields (Commonwealth Secretariat, 1999).

Even though the aim is similar in each country, the extent to which this strategy is being implemented varies in each Member State. With respect to gender mainstreaming, Sweden is depicted as a forerunner. The Nordic country has been actively involved with the strategy since 1994. Since then, gender mainstreaming has been used as the main principle to achieve gender equality within the society (Vosseler, 2015). Gender mainstreaming is incorporated at all levels of the Swedish education system. Thereby, the implementation of this process is one the main goals of the Swedish Institute. The Swedish institute (as cited in Vosseler, 2015) states that “the teaching

methods are aiming to allow each child to grow into a unique individual” (p. 27). This aspect of independence stems from the implementation of the strategy. Extrapolating from these findings, it seems that gender mainstreaming in Sweden has been implemented successfully (Vosseler, 2015).

3.2.3 Sweden strives to become a gender-neutral society

Sweden has made various efforts to stimulate the process of increased female enrolment in the STEM study programmes. Gender equality has been a priority on the Swedish political agenda for decades (De Pous, 2013). The Swedish government has implemented unisex changing rooms in elementary schools, colour-neutral clothing and toys and a variety of organised initiatives. In addition, Sweden uses a gender-neutral pronoun for both boys and girls, called ‘hen’. Initially, these initiatives do not seem to relate to female enrolment in STEM studies. However, these efforts are said to advance the increase of female enrolment in the tech industry (De Pous, 2013).

In Sweden, young children already know what equality (Swedish translation: *jämställdhet*) is. In many Swedish schools, ‘gender pedagogy’ is being used. The premise of gender pedagogy is to make children aware of the gender roles that are often demanded of the opposite sex. Most differences between women and men arise already in pre-school due to traditional gender roles. The teachers should be aware of this and approach everybody in the same way. By breaking down the traditional role patterns, children will be given the opportunity to freely evolve themselves (De Pous, 2013).

In the recent years, measures are being taken in Swedish schools to address gender equality in higher education. For instance, the government took policy measures to introduce gender-neutral schools such as ‘Egalia’ in Sweden⁴. Weller seems to be positive about the effect of the genderless pre-school on children. According to Weller (2015), “The fact that genderless education starts already at pre-school makes us more conscious of the fact that children learn social norms at a very young age.” When looking at the social factors, a gender-neutral pronoun has a lot of impact in society and contributes to gender neutrality. Ayache notes that, “Language shapes the way we think, directly affecting the way we act, and in turn affecting our society at large” (Ayache, 2014).

⁴ The aims and objectives of this gender-neutral school are described in chapter 2. (p. 32)

Countries with gender segregation in their language tend to have more gender segregation in their culture (Ayache, 2014).

However, Hornscheidt, professor of Scandinavian languages and gender studies at Berlin's Humboldt University, observes that "simply introducing a gender-neutral pronoun in other countries may not be sufficient to fight sexism or gender-biases" (as cited in Noack, 2015). Hornscheidt has found that Turkey also has a gender-neutral pronoun which has not been effective enough to fight sexism. In 2014, the country was ranked 125th in the gender equality report of the WEF, while Sweden came fourth. Sweden's introduction of a gender-neutral pronoun does not necessarily determine their success in countering gender inequality. For this reason, it should be taken into account that Sweden's successfulness in reaching gender equality is related to several factors. As Noack remarks, "the gender-neutral education in Sweden goes far beyond linguistics." (Noack, 2015).

Thus, alongside the genderless linguistics, several other factors are committed to help change the way people perceive gender (Noack, 2015). Sweden is at the forefront of addressing these issues in innovative ways (Ayache, 2014). All of these factors can be said to contribute to the relatively high participation rate of women in STEM studies. In addition, the Swedish government is funding a programme which contributes to the increase of women in STEM studies.

3.2.4 SciTech

The SciTech Basic Year aims to increase the interest among young adults in science and technology. It is often difficult to change directions in the last year of high school and many students may not opt for STEM studies in higher education because of the choices they made in high school. Sweden created the SciTech programme to address this issue in 1992. This programme has been commissioned by the Swedish National Agency for Higher Education. Another objective of the programme is to encourage the development of new methods of education in all 18 fields.

In most countries, pupils have to make a choice about their future orientation already around the age of 15. Most of the time, this choice is based upon limited information. For this reason, pupils who are deciding what to study are largely influenced by guidance from teachers and parents who relate the potentials of the pupils with their previous school results. In many cases, this choice is not correlated with the capacities and the preferences of the students. The same problem arises

when pupils have to choose their higher education fields of study. In general, young people are adaptable so they can easily make changes to their study path. Nevertheless, the curriculum structure prevents them from making these adjustments. Thus, in most cases, students who did not choose to study science and technology at the age of 15 are unable to come back to such a field of study later on, even if they wish to do so. For this reason, it is important to make it easier for students to get into the S&T studies at later stages (OECD, 2008).

Students who have completed studies in other fields can study for a supplementary year (basic year) with a focus on science and technology. The students can adjust their choice of courses to their previous knowledge. Many students do not need the full year to regain their knowledge about S&T. Success in this basic year gives the student a guaranteed place at a university (OECD, 2008). Moreover, the SciTech Basic Year is focused on the involvement of women in their programme. The OECD (2008) notes that, "a unique characteristic of the initiative is its focus on gender equality. Special university classes for women have been arranged within the framework of the SciTech program" (p. 97). The SciTech year at a specific university is in most cases connected with a place in a study programme in that university afterwards. However, this supplementary year does not count as part of the first years credits for a diploma (OECD, 2008).

Indeed, this strategy proved to be successful. Every year around 7000 students in secondary school benefit from the SciTech Basic Year. 60% to 70% of the students who registered for this basic year were accepted the year after in S&T at university. It turned out that the students who follow this basic year made similar accomplishments to their fellow students in university courses later on. Half of the students who are accepted into university after participating in the Basic Year are female. The OECD assumes that SciTech may have contributed to an increase in the share of girls studying science and technology in Sweden (OECD, 2008). However, it should be kept in mind that it is difficult to measure the progress made in the achievement of gender equality through the implementation of this programme (CDEG, 2011).

Kristina Sandström, Head of Division Engineering and Sciences at University West, states that the SciTech Basic Year is also within her division. In accordance, Sandström argues that the advantages of the Basic Year for women in STEM are not easy to measure. According to Sandström:

We cannot really tell if it is better or if it is beneficial. I mean, if you attend this programme, of course, you learn a lot. I mean I did it myself, I enrolled for this programme and I think it is a good way to enter into university. If I do not separate men and women, I would not say that the people that took this year are more likely to go through with their studies at the engineering level. So that is a general thing, even if you are a man or a woman, so to speak. (K. Sandström, personal interview, January 29, 2016)

3.2.5 Swedish campaigns to foster female participation in STEM

According to Sandström, the Swedish government has taken a lot of initiative to advance the enrolment of women in the STEM fields of study in higher education. A variety of campaigns have been carried out in primary schools such as 'girls and natural science' and 'girls and technology.' Another example of these campaigns is the implementation of a science summer school. Sandström was involved with this project that one of the science centres in Tröllhattan is in charge of. This science centre works with actually generating interest among young children regarding science and technology.

Moreover, Sandström states that there was a programme that was implemented from 1997-98 until 2000 that made it more accessible for students to change careers. It meant that if you entered a STEM programme in any kind, for example, a Basic year or a college year, you would get a reduction in your student loan (K.Sandström, personal interview, January 29, 2016). Unfortunately, there was insufficient information concerning the implementation of these campaigns and the ways in which these measures were operated. No reliable results have been found that prove how effective initiatives such as 'girls and natural science' are. Nonetheless, the outcomes of the indicated measures could be considered for further research.

3.2.6 The inclusion of society

Sandström states that to reach greater gender equality in higher education, you need to look at the system in general. Not only the initiatives that are taken in the universities, but also the overall idea of gender equality in the Swedish society led to greater gender equality. When looking at the care sectors, in particular, parental leave is paid and divided equally between women and men in the Swedish welfare state. Sandström says that she divided this time equally with her husband. Thus, they were able to stay home up until two years. In most Swedish households, the time is equally divided between the parents similar to this. Moreover, Sandström notes that fees for kindergartens are remarkably low in Sweden compared to many other European Member States such as the

Netherlands, where kindergarten fees are relatively expensive (K. Sandström, personal interview, January 29, 2016).

The division of work between women and men, parental leave and the way in which the nursery schools are organised make it easier for Swedish women to enter the STEM sector. These factors are all interrelated and together they make it easier for women to be equal. Sandström believes that girls around the age of 15 are not likely to be aware of these aspects when they decide to study in the STEM fields in higher education. Yet, these factors led to the fact that there is a sufficient number of female role models that actually work as engineers and not as 'stay-at-home' moms or moms who work part-time. Accordingly, it is very common for Swedish women to participate in STEM (K.Sandström, personal interview, January 29, 2016).

Additionally, the fact that there are no tuitions in Sweden contributed to gender equality in higher education. This has been going on for a long time. Sandström contends that, "in general there has been gender equality in this country for a long time. It has never been a huge issue that women go to university and from there to go to the STEM field is not a big step" (K.Sandström, personal interview, January 29, 2016). However, there are still fewer women who apply for engineering degree programmes or work in the STEM field in total compared with the number of male applicants. Nonetheless, it has never been uncommon in Sweden that women participate in engineering study programmes (K.Sandström, personal interview, January 29, 2016). According to Sandström, "it has not been that unusual, even before the government made efforts to get more women into it" (K.Sandström, personal interview, January 29, 2016). She remarks that, in a few engineering programmes of University West, there is an equal distribution of women and men (K.Sandström, personal interview, January 29, 2016).

3.2.7 Conference: Women in Science and Beyond

In 2009, a conference called "Women in Science and Beyond" was held in Prague. The goal of this conference was to make research institutions aware of the fact that providing equal opportunities to women and men could have benefits for the science and technology sector. On the occasion of this conference, Jacobsson, Deputy of Research Policy Analysis of the Swedish Research Council, utilised examples from Sweden to explain how gender equality in the higher education system could be promoted. When looking at the general gender equality policy measures in Sweden, it seems positive that gender equality has been mainstreamed since the 1990s. Furthermore, the

one-bread-winner is not the norm in Sweden: 81% of men and 87% of women are in the workforce. In Sweden, higher education institutions are obliged to promote gender equality. On the occasion of Sweden's successes, Jacobsson elaborated on the most important factors for promoting gender equality in the higher education system (Jacobsson, 2009). Innovative ways to promote gender equality in the Dutch higher education system will be discussed in the next chapter.

3.3 Conclusion

In conclusion, Sweden's success signifies that this country is in many ways a role model for other countries with less gender equality. Sweden has maintained greater gender equality because of several factors. The country has already been prioritising measures to reduce gender gaps since 1921. More specifically, Sweden has implemented strategies to reach gender equality in higher education. The Nordic country is also at the forefront regarding their successful implementation of the strategy of gender mainstreaming compared to the other UN countries. Likewise, the fact that the Swedish government attempts to counter gender stereotypes already in pre-school contributes to their success. Another effective measure is that Sweden successfully implemented a programme which aims at increasing student participation in STEM studies. The strategy of this programme contains a focus on gender equality because special university classes for women were arranged within the framework of the SciTech programme.

However, it should be taken into consideration that solely the measures that are taken in higher education will not guarantee the achievement of full gender equality. Sandström, head of the division engineering and science at University West, believes that gender equality is caused by several factors and that the whole society should be included in reaching this. Factors such as parental leave, division of work between men and women and the organisation of kindergartens all have influence on the extent to which there is equality between women and men. According to Sandström, role models are very important in encouraging women to participate in STEM study programmes (K.Sandström, personal interview, January 29, 2016). Jacobsson, a member of the Swedish research council, affirms the assumption that examples from Sweden are sufficient to explain how gender equality in the higher education system could be promoted in other countries.

In the next chapter, the measures that have been undertaken by Swedish policy makers in higher education will be considered as new possibilities to be conducted in the Dutch curriculum in higher education. It is speculated that the Netherlands can learn from Sweden with respect to gender

equality policies in higher education and gender mainstreaming in particular. By reflecting on initiatives which could possibly be effective in the Netherlands, the existing difference in the rates between women and men in the STEM study programmes in this country can be narrowed (Vosseler, 2015).

4. Swedish measures to increase female participation in the STEM fields in higher education as an example for the Netherlands

Compared to the other European Member States, the Netherlands is lagging behind concerning the participation of women in the STEM fields of study. Only when more women choose a career in the currently male-dominated STEM-sectors, the Netherlands can maintain and strengthen its position as a knowledge economy in the field of science and technology (Atria, 2015b). The participation of women in STEM employment is linked to their choice of tertiary fields of study (Van Langen, 2005). For this reason, it is recommended that the Netherlands takes action to reduce the gender gap in the STEM fields of studies in higher education.

In order to find out what has already been done in the Netherlands, initiatives that have been taken in the higher education institutions are analysed. Thereafter, additional initiatives that could possibly be introduced in the Dutch education system are described. In doing so, policy measures that are taken by the Swedish government will be taken as a starting point. In this chapter, an answer will be given to the research question: *“What can the Netherlands learn from Sweden concerning measures to increase the female participation in the STEM fields in higher education?”*

4.1 The influence of EU policy on changes in the Dutch education system

It is important to find out to what extent the Dutch government is actively involved in reducing the gender gap in the STEM fields of study in tertiary education. In doing so, it becomes easier to determine what there is left to be done in the Netherlands to address this issue. European Union policy seemed to have attributed to stimulate the Netherlands to increase the participation rate in science education. In the European Member States, many school and business partnerships are devised to “encourage interest in STEM careers at primary, secondary and upper secondary school levels, as well as at the university level” (Caprile, Palmén, Sanz & Dente, 2015, p. 24). These initiatives have been coordinated by the European Union and EU-funded research contributed to the development of these practices in the Member States.

The implemented initiatives and programmes vary between Member States. These initiatives stimulated the Dutch government in creating a national strategy with the aim to encourage students’ interest in the STEM field of studies (Caprile et al. 2015). Caprile et al. (2015) point out that the Netherlands has additionally placed a specific focus on attracting girls and women to

science by introducing the Dutch Science and Technology Platform. The aims and accomplishments of this platform will be described in the next section (Caprile et al. 2015).

Noortje Jansen, a Dutch policy officer working for the VHTO organisation focused on women and STEM, elaborated on the effectiveness of initiatives on European Union level on the Netherlands. Jansen says that EU policy initiatives have influence on the Netherlands to some extent. When attention is paid to the issue of gender inequality in higher education in Europe, that means that attention is paid to this issue in the Netherlands as well. Jansen believes that it helps that the Netherlands are globalising a lot more nowadays, which helps to increase its collaboration with the European Union (N.Jansen, personal interview, December 24, 2015). However, Jansen states that:

EU Member States always have the freedom to interpret the EU policies. Therefore, it depends on how the member states reflect these measures in their own society or education system, but also how they are going to carry them out. The effect of the measure always turns out differently than the measure itself. (N. Jansen, personal interview, December 24, 2015)

However, the Dutch government also took national initiatives to increase STEM participation which were not stimulated by European Union policy-making. For instance, the Dutch Science and Technology Platform is a national initiative that has been established by the Dutch government as a segment of a European programme to seek more recognition on a European Union level (N. Jansen, personal interview, December 24, 2015). The Science and Technology Platform and other initiatives implemented by Dutch policy makers are described in the next section.

4.2 National initiatives taken by Dutch policy makers

In a report on gender equality in the Netherlands by the European Parliament (EP), it is stated that the Dutch government recognises the existence and impact of stereotyping. The EP reports that the government of the Dutch authorities consider stereotyping as one of the causes of the shortages in technology and engineering. Therefore, the government stimulates initiatives to encourage young people to choose less traditionally. For instance, girls are encouraged to choose more often a technical education (Plantenga & Remery, 2015). The policy report on gender equality in the Netherlands by Plantenga and Remery does not provide concrete examples of how these girls are being stimulated to opt for STEM-oriented education.

However, the efforts that are taken by the Dutch government verify that the shortage of the participation of women in the tertiary STEM studies is an issue that has not gone unnoticed in the Netherlands. Since 1984, the Dutch government has been setting up various national campaigns to promote women's participation in STEM education. For instance, in 1987, the 'Choose Exact' campaign was initiated by the Dutch government. The goal of this campaign was to encourage girls to choose science courses at secondary school. Since then, the theme has remained a priority on the Dutch political agenda (Van Langen, 2005).

In contrast to the report by the European Parliament, Van Langen & Dekkers (2005) acknowledge that, "there is little awareness in the Netherlands that subject and course choices are much more sex-specific than in most other western countries and that this leads to lower opportunities for women in the labour market" (p. 12). Initiatives to encourage women to enrol in STEM degree programmes are often not taken seriously or not properly assessed because of the lack of awareness about this issue in the Netherlands (Van Langen & Dekkers, 2005). In the next section, several campaigns that were carried out by Dutch organisations are described. In doing so, the capability of the Dutch government's initiatives to increase female participation in STEM are analysed.

4.2.1 The Science and Technology Platform

Since 2004, the government, education and business sectors have commissioned the Science and Technology Platform (Platform Bèta Techniek) to increase the number of new Science and Technology (S&T) studies institutionally, from primary schooling to the labour market (Caprile et al. 2015). Even though the Science and Technology Platform is mainly focused on youngsters in general, girls and women are specifically targeted within the Platform.

According to the OECD (2008), the platform's aim was "to increase the number of new S&T graduates in 2010 by 15% compared to 2000 and to ensure that scientists and technologists are more effectively retained and used" (p. 95). The initiatives of the Science and Technology Platform proved to be successful. Caprile et al (2015) declare that the Platform has accomplished to increase the number of enrolments in scientific and technical education with 15%. In order to attract more young people to participate in the STEM field of education, a comprehensive approach to the problem is necessary. Therefore, the Platform targets schools and universities but also industries, policymakers and specific regional and economic sectors (Caprile et al. 2015).

4.2.2 Jet-Net

Jet-Net, the 'Youngsters and Technology Network' of the Netherlands, is a collaboration between companies, educational institutions and the government. The goal of this partnership is to give HAVO and VWO⁵ pupils in secondary education a realistic view on STEM and to make them interested in pursuing a study programme in the STEM fields in higher education (Jet-net, n.d).

An initiative called 'Girlsday,' which has been carried out by the VHTO, is actively supported by many Jet-Net companies. During this day, girls from the age of around 10 to 15 get the chance to look behind the scenes of the Dutch technological industry. By creating 'do it yourself' activities and excursions they discover the world of science, technology and ICT. Moreover, they get to meet (female) professionals from these sectors and they learn about the daily practices of STEM professions in an interactive way. The goal of Girlsday is to let the girls experience how fun, challenging and meaningful it can be to work in the STEM sector and to provide them with a clear picture of the study programmes and professions that are associated with this field (Girlsday, n.d).

More information on this project has been found on the website of VHTO. The organisation reveals that thanks to diverse efforts and the collaboration between public and private, the number of HAVO and VWO girls that choose for a science study profile has increased over the past ten years. Moreover, the number of female entrants in STEM tracks has grown. Nevertheless, attention continues to be necessary. Exact numbers of the increase of female participants in STEM are not provided on the website of the VHTO organisation. Since no reliable proof has been found on the outcomes of this project, the impact of Girlsday on the female participation of STEM remains debatable (Girlsday 2015, n.d).

4.2.3 VHTO

The VHTO organisation is a national organisation focused on girls/women and STEM, situated in Amsterdam (Missie en visie, n.d). This organisation is active in the entire education chain. The objectives of this network are to gain more insight into the factors which play a role in career choices and professional careers of girls and women in the direction of STEM. Likewise, they detect new approaches to effectively improve the underrepresentation of girls and women in STEM (Network Gender, n.d). Ms Jansen, policy officer of the VHTO organisation, suggests that the

⁵ The education levels of HAVO and VWO are explained in chapter 2. (p. 29).

organisation is actively involved in stimulating girls to choose a programme of studies in the STEM field. In doing so, VHTO pays extra attention to the increase of gender awareness amongst teachers in all education levels, but also the provision of role models (N. Jansen, personal interview, December 24, 2015).

4.2.3.1 The VHTO approach (2004-2011)

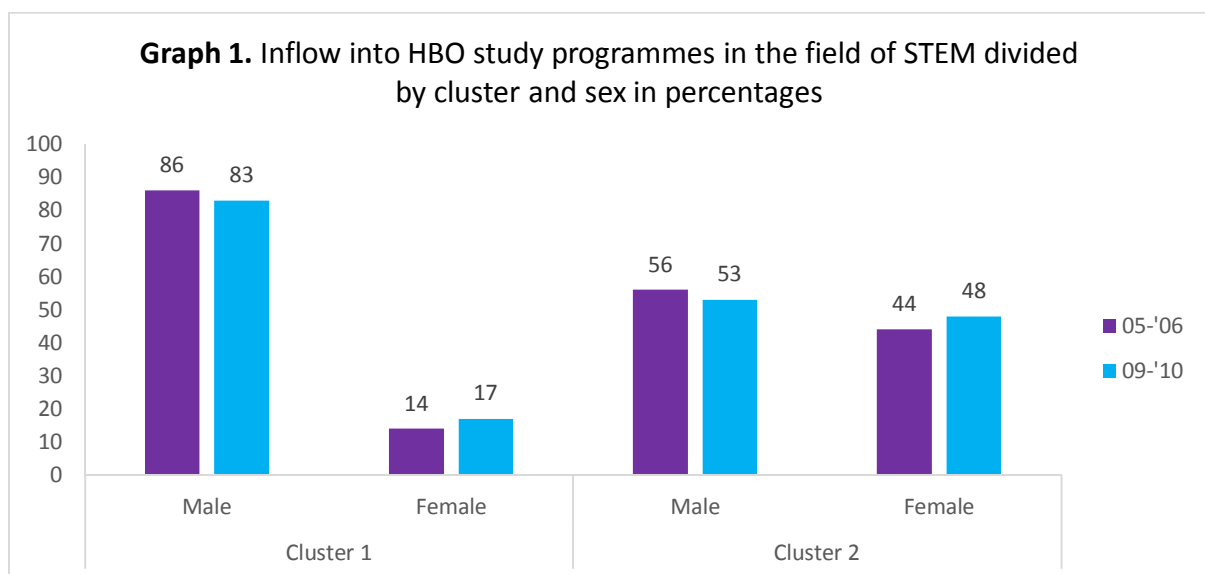
The VHTO organisation collaborates with the Science and Technology Platform and the Dutch Ministry of Education, Culture and Employment. Together, they have developed an effective approach from 2004 until 2011 to stimulate women to choose a study profile in the STEM field in secondary education and to encourage them to opt for a study programme in the STEM field in higher education. In the recent years, 183 secondary schools devoted themselves to encourage pupils to opt for a science study profile in collaboration with the Science and Technology Platform.

Likewise, 145 of these schools collaborated with VHTO to pay specific attention to pupils decision-making in choosing a study profile, but also in deciding what to study in higher education. The introduction of 'speeddating' is a way in which VHTO attempts to make girls acquainted with the variety of possibilities in the STEM fields and the female professionals who are satisfied by working in this sector. Speed dates are conducted with female professionals and female students during the transition process of girls who are deciding what to study in higher education (Booy et al. 2011). Girls in secondary education get the chance to talk with women in STEM study programmes or women who work in the STEM sector. These women have enrolled themselves as role models in the VHTO database. The conversations last 15 minutes and are mostly about work, study paths and career choices (Speeddaten, n.d).

It turned out that in the schools that have chosen for the 'VHTO approach', in general, the highest number of girls chooses a 'nature and science' study profile. This tendency is noticed in both HAVO and VWO. The VHTO strategy seemed to be effective in secondary schools, but it has also been successful in increasing the intake of girls in STEM fields of study in higher education. According to the VHTO, the speed dates largely contributed to this recent increase (Booy et al. 2011). Since VHTO took other initiatives besides the speed dates in the same time period, there is no credible evidence that this particular initiative was the most effective in addressing this matter.

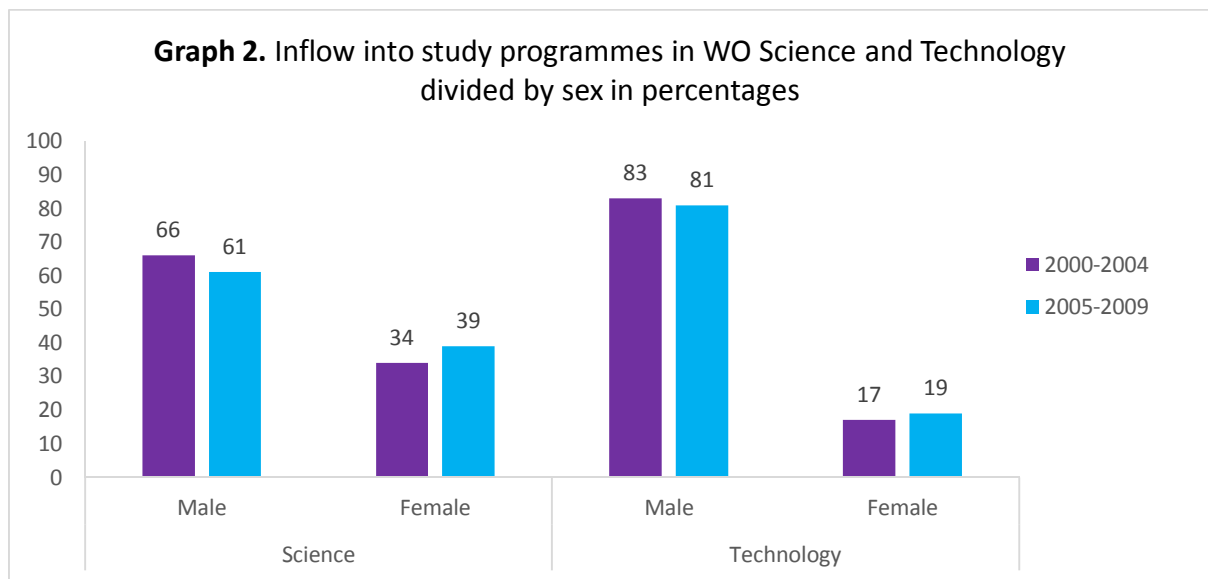
4.2.3.2 Results of the VHTO approach

As demonstrated below, the inflow of women in STEM degree programmes in HBO and WO expanded in the period from 2005 to 2010. In 2000, the Science and Technology Platform divided STEM higher education into clusters which are used in the graph below to show the inflow of students into HBO study programmes in the field of STEM. Cluster 1 entails the study programmes that are considered to consist of 100% Science and Technology. The second cluster includes study programmes that consist of more than 50% Science and Technology content, such as biotechnology (Booy et al. 2011).



Source: ResearchNed, Science and Technology Platform, 2011

Graph 1 shows that the inflow of women increased more than the inflow of men. However, a large difference between the clusters is detected. Almost half of the female students were enrolled in cluster 2 while the female participation rate in cluster 1 is around 17 percent (Booy et al. 2011). The results of this graph indicate that female students seem to be more interested in a wider variety of study programmes in the field of STEM compared to the 'traditional' science and technology degree programmes. Likewise, the increase of women in these traditional study programmes seems inadequate since there is still a large gender gap noticed in these fields.



Source: CBS/DUO, 2011

The second graph demonstrates the inflow of male and female students into study programmes in the traditional Science and Technology fields in higher education. The results of this graph suggest that there was an increase of female students in these degree programmes from 2004 to 2009. Nonetheless, mainly in the field of Technology, an unequal distribution of male and female students is noticed (Booy et al. 2011).

Jansen confirms that the policy measures taken by VHTO in education proved to be successful. However, the policy officer argues that the schools that chose for the VHTO approach might have been already more aware of gender segregation in STEM. Therefore, it cannot be ascertained whether the gender awareness among the schools or the influence of the VHTO approach contributed to this increase (N. Jansen, personal interview, December 24, 2015). Nonetheless, a wider range of study programmes in the field of STEM in tertiary education seems to be appealing to female students (Booy et al. 2011).

4.2.4 Sweden and the Netherlands have taken similar measures

Both on a national and an international level, measures are undertaken which are implemented in the political agenda of the Netherlands. Additionally, the variety of initiatives carried out by the Dutch policy makers suggests that much has been done to counteract gender stereotypes in higher education nationally. The VHTO organisation, the Science and Technology Platform and Jet-net

made efforts to increase female representation in STEM by a variety of campaigns. However, these efforts did not lead to profound changes in the rate of women in these fields.

Even though the 'VHTO approach' in secondary schools resulted into an increase of the inflow of women into STEM study programmes in HBO as well as WO, an unequal distribution of male and female students in these fields remains in the Netherlands. However, the Netherlands does not seem to be underperforming compared to Sweden since national policymakers in both nations are actively campaigning to realise this.⁶ The range of possibilities for the Netherlands to further the process of encouraging women in pursuing a study programme in the STEM field Netherlands are described in the next sections. In doing so, Sweden will be taken as a starting point.

4.3 Swedish initiatives as an example for the Dutch government

4.3.1 Changes to the Dutch education system

In the Netherlands, pupils in HAVO and VWO have to choose their study profile in secondary education quite early, around the age of 14/15. Jansen claims that, "In the Netherlands, pupils are obliged to choose subjects at an extremely early age." (N. Jansen, personal interview, December 24, 2015). She thinks that it might be positive if the educational choice of pupils is postponed in the Netherlands since pupils in many other European Member States can make this decision at a later age. In addition to the fact that Dutch pupils have to make decisions about subjects early in their educational career, there are hardly any possibilities to change their study track. For instance, if pupils decide to choose for a culture & society profile, there are limited options to switch to a nature & science profile (Booy et al. 2011).

In Sweden, it is easier for students to change tracks after they made choices at lower levels in education by means of the SciTech Basic Year (OECD, 2008). The outcomes of the interview that was conducted with Sandström, Head of Division of Science and Engineering at University West, provided for more information on the Basic Year Programme. Sandström believes that this programme provides the opportunity for students to change their study paths and it lowers the threshold to enter university. However, she does not think that men and women should be separated in this matter. Additionally, the interviewee cannot really tell if this programme is

⁶ National campaigns by the Swedish government to foster female participation in STEM are described in chapter 3 (p. 40).

beneficial to women. It remains unclear if it will be effective when a similar programme would be implemented in the Dutch education system. There are no concrete facts on the impact that such a programme could have on the female participation in STEM in the Netherlands, seeing that no similar initiative has been taken by the Dutch authorities. Nonetheless, the programme might contribute to new graduation options in the STEM fields of study in the Netherlands (Van Langen & Dekkers, 2005).

4.3.2 Gender-neutral pre-schools

A noteworthy initiative by the Swedish education system is the introduction of gender-neutral pre-schools. De Jong, employee at the International Office of the Faculty of Architecture at the Technical University of Delft, agrees that stereotyping already starts from a young age and should, therefore, be prevented already in pre-school (D. de Jong, personal interview, January 15, 2016). Jansen seems to contribute to this assumption by remarking that already in kindergarten, girls tend to be less confident regarding their competencies in STEM subjects compared to boys.

Simultaneously, boys overestimate their skills in the STEM courses. Teachers and parents are likely to base their advice on the attitude of their children towards STEM courses. Besides, a lot of parents have stereotyped perceptions of what is a 'girls thing' and what is a 'boys thing' (N. Jansen, personal interview, December 24, 2015). Miller et al. (2014) support the assumption that cultural stereotypes are developed by observations that begin at early ages (Miller et al. 2014). Miller et al (2014) state that, "kindergarten girls endorsed gender-mathematics stereotypes if their female teacher was anxious about mathematics (p. 631)." Therefore, the possibility of implementing gender-neutral approaches in pre-schools and primary schools is analysed.

As described in chapter 3, gender-neutral pre-schools have been introduced in Sweden. Not only in gender-neutral schools, but also in many other Swedish schools, teachers make children aware of the gender roles that are often demanded of the opposite sex (De Pous, 2013). The interview respondents Jansen, De Jong and Sandström all provided a different stance on the effectiveness of gender-neutral schools in countering gender stereotypes.

De Jong believes that in the Netherlands, there is already equality- at least to some extent- in primary schools. She argues that her children's primary school has a construction table and all children- boys and girls- are obliged to play with it, which implies that the Dutch education system

is already aiming to achieve greater gender equality (D. de Jong, personal interview, January 15, 2016).

4.3.3.1 Jansen's view on gender-neutral schools

Jansen believes that the initiative of Sweden to implement gender-neutral pre-schools is a positive development. She argues that this initiative might be an interesting solution to the very early gender-segregation. From her point of view, equality schools would succeed in the Netherlands as well. However, it should be taken into consideration that despite putting your children on these schools, traditional gender roles are still likely to influence them. These gender roles are caused by external factors, namely the media and influences from the outside, mostly parents and teachers (N. Jansen, personal interview, January 15, 2016). Jansen points out that (2015), "the media is still blowing things out of proportion concerning gender roles." Furthermore, equality schools are not the only solution according to Jansen. The interviewee claims that it would also be an important policy measure to stimulate gender consciousness among teachers in primary schools as well as professors in higher education (N. Jansen, personal interview, January 15, 2016).

4.3.3.2 Sandström's view on gender-neutral schools

Sandström seems to be somewhat critical about the gender-neutral pre-schools. She declares that there has been a lot of discussion about the gender-neutral pronoun 'hen,' because several studies have proven that children should be aware of their gender. In addition, she remarks that already since the 1970s, nobody has been making differences between boys and girls in this matter. Sandström states that, "if you wanted to play with Lego, you could. If you wanted to play with dolls if you're boy, I mean no one would raise an eyebrow, not at all, no-one." (K. Sandström, personal interview, January 29, 2016). Nonetheless, Sandström says that there are- of course- differences between boys and girls in Sweden which means that they are not 'perfect'. For instance, there is still a girls and a boys section in H&M. However, she claims that if you want to make girls interested in STEM subjects, you have to start early. It is too late to start encouraging girls to choose STEM in high school (K. Sandström, January 29, 2016).

4.3.3.3 Effectiveness of gender-neutral pre-schools

In conclusion, De Jong points out that the Dutch government is already taking efforts to make primary schools more gender equal. Jansen reveals that it might be even more important to stimulate gender awareness amongst teachers instead of children. Sandström argues that the

gender-neutral pre-schools did not seem to make much change in Swedish society seeing that their society has already been less bound to gender roles since the 70s. The outcomes of a study on gender-neutral schools or 'single-sex education' carried out in several Western countries presented in a CDEG report serve as an example for the difficulties in measuring its effectiveness. Smyth (as cited in CDEG, 2011) states that:

Despite considerable variation between and within countries in the conclusions reached, depending on the research methods and analytical techniques employed and outcomes considered, there appears to be very little consensus on whether single-sex education is advantageous to girls' or boys' academic achievement. (p. 15)

Likewise, no trustworthy evidence has been found that proves that Swedish gender-neutral schools help to increase female STEM participation in this country or elsewhere. Since no gender-neutral schools have yet been introduced in the Netherlands, it appears to be difficult to estimate the benefits of it. Therefore, this Swedish measure does not (yet) seem to have a positive impact on girls' interest in STEM courses when it will be adopted in the Dutch education system.

4.3.3 Gender mainstreaming in Sweden and the Netherlands

As explained in the previous chapter, the gender mainstreaming strategy has been adopted by all Member States of the European Union since the World Conference on Women in Beijing in 1995 (UN, n.d). However, the extent to which gender mainstreaming is implemented in higher education is different in each UN country. Sweden is perceived as a role model in this matter seeing that this Member State has actively been involved with the strategy since 1994, so one year earlier than the UN Declaration (Vosseler, 2015). In contrast, Verloo (2001) states that the Netherlands faced difficulties already between 1975 until 1995 with successfully implementing gender equality policies in higher education because it has been very unusual for political departments to put equality high on their agendas. It seems that these earlier negative experiences can be attributed to the weak political support and the lack of concrete tools and instruments to implement the gender mainstreaming strategy (Verloo, 2001).

4.3.4.1 The implementation of gender mainstreaming in the Netherlands

According to a 2007 report by the Dutch emancipation commission, 'Visitatiecommissie Emancipatie', the Netherlands has deteriorated since the 1990s concerning the main conditions for a successful implementation of the process of gender mainstreaming. The commission argues that

individual civil servants lack general knowledge about gender and emancipation. In addition, a lack of attention amongst these civil servants is noticed. For many office holders, emancipation is not a 'hot topic' anymore. Moreover, the government often fails to assess whether the Dutch communities actually make an effort to implement this strategy and its possible results. Apparently, communities face obstacles similar to the government concerning the implementation of gender mainstreaming (Naezer, 2007).

Nonetheless, Verloo (2001) expresses that the Netherlands has had a relatively long history of equality policies. Therefore, the author argues that the 'problem' seems to be caused by the way in which these policies are adopted by the government rather than a lack of initiatives to stimulate gender equality in the Netherlands (Verloo, 2001). While the successfulness of an acknowledged implementation of gender mainstreaming in the Dutch curriculum is scrutinised, the gender roles in society should be taken into consideration. Since the gender mainstreaming strategy partly aims to encourage women in science and technology⁷, a successful implementation of this strategy seems to help to achieve greater gender equality in the STEM fields of study in the European Member States.

4.3.4.2 The necessity of gender mainstreaming

As an affirmation, Booy et al. (2011) claim that gender mainstreaming in Dutch higher education is necessary since it helps to exploit the potentials of girls. Amongst many study programmes in the STEM field in the Netherlands, gender has not yet been embedded in the full width and characteristic quality in policies and activities. To reach gender balance in these study programmes, it is crucial to 'gender mainstream' all the policy plans and activities arising from it, that is to consider if these initiatives will be equally effective for female and male students. Booy et al. (2011) recommend that Dutch technical universities should pay more attention to gender effects when they carry out new plans.

4.3.4.3 Cultural factors affect the implementation of the strategy

Vosseler (2015) points out that in the Netherlands, gender mainstreaming did not prove to be very effective because Dutch society is still shaped by the traditional gender roles which are also reflected in the social welfare policies. From her point of view, the reason why Sweden is doing

⁷ The aims and objectives of gender mainstreaming are described in chapter 3 (p. 36).

better is because this country is already gender-egalitarian, which made it easier for the Swedish government to successfully carry out the strategy of gender mainstreaming nationally (Vosseler, 2015). Therefore, the author suggests that it might not be equally effective for the Netherlands when their education system becomes as involved as Sweden in the process of gender mainstreaming. Thus, a similar approach to this strategy might not necessarily ensure greater gender equality in Dutch higher education.

4.4 Conclusion

In conclusion, the Dutch policy makers have done much to counteract gender stereotypes in higher education nationally. Moreover, both the Netherlands and Sweden have adopted the strategy of gender mainstreaming in its policy. This strategy was implemented on an international level. From the description of the several Dutch campaigns to foster the promotion of STEM amongst girls and women it can be inferred that the Netherlands is doing well concerning the implementation of these initiatives. As a result, Swedish measures that have been analysed to find out if they would be effective in increasing the female participation rate in the STEM fields in Dutch tertiary education do not provide justified evidence that it would foster this increase.

Both countries adopted similar initiatives in the recent years to enhance STEM participation, such as campaigns carried out in primary, secondary and higher education (Van Langen, 2005). Accordingly, for the Dutch government, there does not seem to be much left to learn from Sweden concerning the implementation of policy measures to address this matter. Thus, the differences between Sweden and the Netherlands concerning the representation of women in STEM do not seem to derive from the lack of policy initiatives of the Dutch government.

Several factors imply that Swedish society is more aware of the importance of gender equality in education compared to the Netherlands. For instance, the Swedish government makes children aware of gender equality already from a young age by introducing gender-neutral schools. Moreover, Sweden is depicted as a forerunner concerning their successful implementation of gender mainstreaming in all policy areas including the education system.

In contrast, it seems that Dutch teachers and parents still hold stereotypic perceptions towards gender roles. Besides, gender mainstreaming did not prove to be very effective in the Netherlands because traditional gender roles affected social policy in this country. In addition, Van Langen &

Dekkers dispute that there is a lack of awareness in the Netherlands that course choices are still very sex-specific in this country. Initiatives to encourage women to enrol in STEM degree programmes are often not taken seriously or not properly assessed because of the lack of awareness about this issue in the Netherlands (Van Langen & Dekkers, 2005).

Therefore, the differences between Sweden and the Netherlands concerning the representation of women in STEM in tertiary education seem to derive mainly from cultural differences. The impact of cultural factors on the number of women in the STEM fields of study will be further explained in the next chapter. In doing so, the extent to which Dutch culture held back an increased female participation in the STEM fields of study in higher education will be described.

5. The influence of Dutch culture on female participation in the STEM fields of study in higher education in the Netherlands

As described in the previous chapter, the fact that the Netherlands is underperforming concerning the representation of women in the STEM fields in higher education seems to be caused by cultural factors in society. Therefore, it is important to find ways to include the whole of Dutch society in achieving greater gender equality in this field of education. In this chapter, an answer will be given to the following research question: *“How does Dutch culture hold back an increased female participation in the STEM fields of study in higher education?”* This question will be answered by elaborating on the relation between government policy and social traditions, cross-national differences between Sweden and the Netherlands and the ways in which Dutch society is perceived as gender-traditional.

5.1 The inclusion of gender equity in society

5.1.1 Government policy and social traditions

In order to estimate the influence of Dutch culture on participation rates in STEM, Dutch society will first be compared with Swedish society. In doing so, Sweden is perceived as a role model. Despite similarities concerning policy attitudes and the identified problem, Sweden and the Netherlands differ from each other concerning the number of female students that choose STEM education (Van Langen & Dekkers, 2005). It seems that these differences between the European Member States are not only affected by the results of the initiatives taken by national authorities, but also by the way in which stereotypes occur in their society. Miller et al. (2014) observe that, “stereotypes are formed and changed, in part, by repeatedly observing members of different social groups in role-linked activities (p. 632).”

This theory can help to explain why stereotypes about social groups differ between countries. As an example, Bowen & Skirbekk (cited in Miller et al., 2014) report on a study that, “For instance, stereotypes about the older adults’ incompetence were weaker in nations where more older adults participated in paid and volunteer work; this cross-national relationship remained even after controlling for national differences in older adults’ cognitive abilities” (p. 632). Extrapolating from these findings, it seems that the social roles assigned to women and men are also different within cultures across nations (Miller et al., 2014).

Moreover, Van Langen (2005) argues that the extent to which there is gender equality in a nation has influence on the representation of women in STEM education by pointing out that, “A final

explanation for the cross-national differences in female participation in STEM courses relates to the extent to which government policy and social traditions include, and have included, in the past, gender equity” (p. 108).

The inclusion of gender equality within society should be considered when the differences between Sweden and the Netherlands concerning STEM participation are analysed. The cultural differences in these nations, together with initiatives taken by the governments, have an impact on female participation in the STEM fields. Government campaigns are often aimed at influencing social attitudes. Government policy therefore partly overlaps the effect of social views. The influence of the government is mostly noticeable in the funding of education reforms and experiments to promote interest in STEM subjects (Van Langen, 2005).

5.1.2 Cross-national differences

Nevertheless, government policy does not seem to be equally effective in changing social attitudes with respect to women in STEM in each country. In the Netherlands, it might be more difficult to successfully promote more female participation in this field of education compared to Sweden. Van Langen and Dekkers state that this country is considerably less aware of gender stereotyping in higher education in contrast to Sweden. The Swedish policy makers have actively promoted gender equality for decades, which can be noticed by the position of women in society and on the job market⁸ (Van Langen & Dekkers, 2005). Therefore, Van Langen argues that similar initiatives to promote gender equality in higher education do not always guarantee the same effectiveness when they are implemented in different nations (Van Langen, 2005).

The author states that gender consciousness in society and the high uptake of women in STEM are interrelated (Van Langen, 2005). Van Langen (2005) points out that, “For female students, in particular, the choice of a STEM course is more attractive in Western countries that are more gender conscious and advanced regarding women’s emancipation and where it is more customary or necessary that mothers work full-time” (p. 112). The authors’ argument contributes to the previously described assumption that Swedish society is less bound to gender roles compared to the Dutch society. Among others, this may have led to the increased interest in STEM courses in Sweden (Van Langen, 2005).

⁸ More information on Sweden as a gender-neutral society can be found in chapter 3 (p. 37)

5.2 The Netherlands as a gender-traditional society

The Netherlands is still dominated by the stereotype that sciences, engineering and ICT fields belong to men. Youngsters, but also teachers and parents often have a limited view of the possibilities and often have no women working in these fields (Atria, 2015a). According to Charles (2011), "the Netherlands has long been considered a gender-traditional society in the European context."

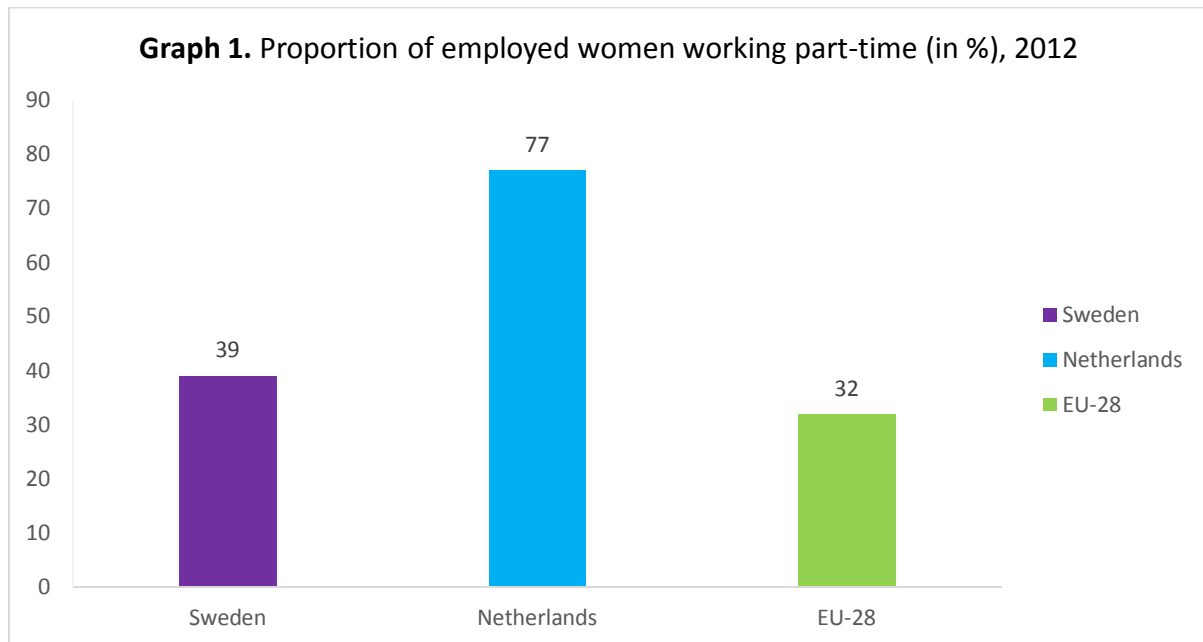
5.2.1 The breadwinner model

Both interviewees, Jansen and de Jong, seem to agree that Dutch society is traditional with respect to gender roles. Jansen shares her opinion with the VHTO organisation in this matter. Despite the fact that there is a high labour participation rate in the Netherlands, most women continue to work part-time. This tendency appears to be caused by historical matters. Dutch women entered the labour market later compared to other countries. In the Netherlands, only a small number of men left to fight in the World Wars compared to, for example, America and Britain. The Netherlands was already a wealthy country at that time. Thus, it was not essential for women to work in order to live comfortably (Why so many, 2015). Another factor which seemed to maintain traditional gender role patterns is described by the VHTO. The organisation states that the Netherlands originally had a 'breadwinner model' that was encouraged by the Christian Party until the 1980s (N.Jansen, personal interview, December 24, 2015). Additionally, the economist points out that, when Christian values dominated Dutch politics, "the focus was mainly on providing state aid so that women could stay at home with children" (Why so many, 2015).

A breadwinner model indicates that men usually work full-time and women stay at home to do the housekeeping and to care for the children in a traditional family. From the 1980s, there were remarkable developments in the Dutch labour market because of the growth of part-time jobs. The creation of part-time jobs made a resolution to the prevalence of the traditional roles of the husband as the 'breadwinner' and the wife as the 'stay-at-home mother' (Plantenga, 1996). Nonetheless, the cultural conviction that families needed mothers to be home for tea time prevailed. Therefore, the state worked closely with employers to ensure that part-time jobs remain equivalent to the full-time jobs concerning its legal positions. In doing so, it became easier for women to enter part-time jobs (Why so many, 2015).

The share of working women is currently high in the Netherlands. However, part-time jobs are dominated by women in Dutch society and, therefore, half of the women in the job market remains economically dependent (Plantenga & Remery, 2015). The number of women in part-time jobs in

the Netherlands is the highest in comparison to Sweden and the remaining 26 EU Member States (EC, 2014). These differences are demonstrated in the graph presented below.



Source: Eurostat, LFS, 2014

Extrapolating from the findings presented in graph 1, it seems that women in the Netherlands are less likely to devote themselves to full-time jobs than women in Sweden and other EU countries. As explained before, most jobs in the STEM fields are full-time. The domination of Dutch women in part-time labour and the long-lasting effects of the breadwinner model are said to be aspects that led to the underrepresentation of women in STEM in tertiary education in the Netherlands (N. Jansen, personal interview, December 24, 2015). Besides, Jansen claims that women in the Netherlands are likely to opt for a degree programme which they enjoy, instead of choosing a study path which will ensure them of finding a successful job. Parents and teachers in schools contribute to their decision by stimulating girls to enrol in a study programme they take joy in (N. Jansen, personal interview, December 24, 2015).

5.2.2 The role of teachers and parents in the promotion of gender equality

According to De Jong, parents play a considerable role in the decision-making of youngsters in the transition process from secondary to tertiary education. De Jong points out that most parents in the Netherlands are still very conservative (D. de Jong, personal interview, December 24, 2015). The CDEG (2011) agrees that "parents play a major role in the early socialisation of their children and continue to influence their personal, educational and other choices throughout their years in

school. Parents also transmit their values, beliefs and cultural traditions to their children” (p. 18). The Committee argues that national policies on gender equality that are directed towards addressing those factors among boys and girls in education are not effective when parents are not included in these kinds of activities. The CDEG recommends that parents should also be involved in the promotion of gender mainstreaming in schools (CDEG, 2011).

In addition, Atria states that parents, as well as teachers, play a big part in the encouragement of girls to choose a study in the STEM field. According to Jansen, many teachers in the Netherlands contribute to gender stereotyping towards students, albeit unconsciously. This might affect the participation rate of females in STEM negatively. The interviewee claims that, when teachers in the Netherlands treat boys and girls differently concerning their capacities, they are not aware of it in most cases.

The VHTO conducted a research to prove that teachers often unconsciously reflect their stereotyped perceptions on their pupils. The VHTO made film fragments of teachers in primary and secondary education while they were teaching in a class. Afterwards, the teachers could see the fragments themselves. In most cases, “they were amazed that they would hold this stereotypical view in such an early stage” (N. Jansen, personal interview, December 24, 2015). Jansen states that it is important that teachers in the Netherlands become aware of the ‘dangers’ of gender stereotyping in education (N. Jansen, personal interview, December 24, 2015).

An example of how Dutch teachers influence girls’ self-concept towards their capacities in STEM subjects is described in Booy et al. (2011). Conjointly, Jansen elaborated on this phenomenon during the interview. In the Netherlands, boys and girls who are performing equally in mathematics and science quite often get contrasting advice from teachers and counsellors. Boys who attain a high grade for mathematics are stimulated to choose a science study profile while girls with the same grade are frequently discouraged to make such a decision. Teachers often assume that girls achieve high marks for maths by working hard. Simultaneously, it is presumed that, when boys accomplish to attain a similar grade, this is probably based on their capacities rather than hard work (Booy et al. 2011).

In order to ensure that women get the same opportunities as men, it is the task of the parents, counsellors and teachers to encourage girls in education (Atria, 2015b). However, De Jong believes that the low participation rate of women in STEM does not only derive from the influence of teachers and parents on female pupils but mostly relates to the differences between the roles of

women and men in the Netherlands. In the next section, the unequal distribution of tasks among women and men in the Netherlands is described.

5.2.3 Unequal distribution of tasks among women and men

According to Schiebinger (cited in Van Langen, 2005), the unequal distribution of tasks among men and women can be problematic since most jobs in the STEM sector are still full-time and acknowledged to be demanding and inflexible. Additionally, Baker & Jones (cited in Van Langen, 2005) explain that, "the extent to which this is a problem depends on the full-time participation of women in the labour market, possibly coupled with the availability of (affordable) childcare and parental leave" (p. 107). The fact that most STEM jobs are full-time appears to be unsatisfactory for women in Dutch society, since there is a high percentage of women in part-time work, accompanied with part-time childcare. Moreover, the ephemeral nature of pregnancy leave for men, referred to as paternity leave, contributes to the unequal role distribution of household tasks and childcare duties (Plantenga & Remery, 2015).

De Jong points out that in the Netherlands, paternity leave is only for 2 days in the Netherlands. Thus, she states that is not accepted in Dutch society if men want to work fewer hours. De Jong claims that:

In the Netherlands, it is expected from women to care for the children. You either have to decide to not get children or you should have a husband who looks after them. As a substitute to this, the nursery schools should be well arranged. Nowadays, you still need to be at home before six o'clock to pick up your children from the nursery schools. The indicated means that this will not work out when you have a regular job with longer working hours. (D. de Jong, personal interview, January 15, 2016)

Ultimately, de Jong argues that, "As long as no changes are being made, it remains difficult for women to get a serious job to which they can commit themselves for the full 100 percent" (D. de Jong, personal interview, January 15, 2016). In the next section, it is explained how a shortage of women in STEM employment leads to a lack of female role models in STEM available for girls.

5.3 The lack of STEM role models in Dutch society

Another way in which Dutch culture seems to suppress women from participating in the STEM fields of study is the lack of female role models who study or work in this field in this country. Jansen relates that there are only a few role models in the Netherlands since only a small number of

women participate in the STEM fields of study, often leading to fewer women in STEM employment. This phenomenon will lead to fewer women in STEM by means of a 'vicious circle.' She believes that because of this vicious circle, gender stereotyping remains strong in the Netherlands (N.Jansen, personal interview, December 24, 2015).

Miller et al. (2014) endorse that it is important to make more role models available since they can positively affect young girls, female high school students or undergraduate female STEM majors who identify with their female professor. In addition, Jansen endorses the view that "it is all about the role models" (N.Jansen, personal interview, December 24, 2015). Jansen believes that more role models should become available in the Netherlands. Girls can emulate fewer role models than boys seeing that most girls in the Netherlands hardly have any female professionals in the field of STEM in their vicinity (Booy et al. 2011).

The VHTO organisation attempts to address this issue in various manners. As described in the previous chapter, the VHTO organisation has been carrying out a project in the recent years to provide more female role models who are specialised in the STEM fields. Even though this initiative seems to contribute to an increased share of women in this field, there remains a large gender gap in STEM study programmes in the Netherlands.⁹ The relatively low impact of the 'VHTO approach' could be due to the assumption that girls are not stimulated by role models if they do not identify with them. Accordingly, Jansen aims for 'normal women' who enjoy doing their job in the STEM fields, because being able to identify with them is the most important (N.Jansen, personal interview, December 24, 2015).

5.3.2.1 The identification is important

The assumption that the identification is the most important in achieving a gender balance in STEM was supported by a study that was conducted by Stout et al. in 2011 to find out how male and female professors affect students who take STEM subjects, in a period of three months (cited in Miller et al. 2011). The outcomes of this study demonstrated that taking a STEM course from a female rather than a male professor can even strengthen gender stereotypes if students do not identify with their professor (Young et al., cited in Miller et al. 2014). This study might serve as an example of the theory that several observations of 'counter-stereotypic women,' such as female

⁹ More information about this approach can be found in chapter 4 (p. 47).

professors teaching science courses, did not show a strong change in stereotypes (Miller et al. 2014).

Furthermore, the authors argue that it takes time to change people's perspectives on women in relation to STEM in order to effectively reduce gender stereotyping in this field (Miller et al. 2014). According to Miller et al. (2014), "people need multiple, mutually reinforcing examples to see counter- stereotypic individuals as evidence of trends. Otherwise, sparse counter-stereotypic examples can be dismissed as atypical through a process called *subtyping*" (p. 632). The concept of subtyping can be explained by using female scientists as an example.

It is often assumed that it is uncommon for a woman to become a scientist. Female scientists could be perceived as having followed exceptional study paths and they probably needed to exert notable effort to accomplish this. In this case, female role models in science might not be sufficient to successfully encourage girls to participate in STEM. Miller et al. (2014) acknowledge that, "these stereotyping processes may explain why experimental studies have revealed that exposure to successful women engineers and mathematicians have not consistently weakened gender-STEM stereotypes" (p. 632).

5.3.2.3 The effectiveness of STEM role models in Dutch society

Accordingly, it seems that the introduction of role models will only be effective in the Netherlands if women who work in the STEM sector are perceived as 'normal' in society. When girls and women do not identify with the female role models in STEM because they do not familiarise with them this initiative will work out wrong. This theory might especially be applicable to the Dutch society, where people tend to be less familiar with women who work in these fields compared to, for example, Sweden (K.Sandström, personal interview, 29 January 2016).

According to Booy et al. (2011), many girls and women in the Netherlands assume that working in the STEM sector is seemingly boring and difficult and, therefore, unpleasant. Accordingly, the shortage of role models in Dutch society seems to be caused by cultural factors. For this reason, Sandström claims that the whole of the society needs to be included in providing role models who will actually change girls' perceptions of women in STEM. The interviewee argues that it is not impossible to decrease gender stereotypes amongst Dutch girls and women in STEM by means of using good female role models who work in this sector (K.Sandström, personal interview, 29 January 2016). It should be taken into consideration that it takes time to include the whole Dutch society in achieving positive developments with the provision of role models.

5.4 The achievement of greater gender equality is an ongoing process

The achievement of greater gender equality in the STEM fields of study in the Netherlands appears to be an ongoing process (Caprile et al. 2015). The World Bank report (2011) states that progress in reducing gender gaps in the STEM study programmes has been slow because there are multiple barriers to change. The authors of the report assert that stereotypes within the education system should be countered as well as social norms governing gender roles which lead to gender stereotypes. Thus, it appears to be not enough to decrease gender stereotyping exclusively in the education system. It is essential to change social norms which tend to maintain gender roles and, therefore, the whole society should be included in this process (World Bank, 2011).

Social norms are prevailing in society, since “social norms are implicit in the operations of a society and make it what it is” (Bicchieri, 2006, p. 9). Thus, it will take time to transform these social norms. The history of gender stereotyping is long and deeply entrenched in Dutch culture and society (CDEG, 2011). According to Caprile et al. (2015), “Transforming young people’s attitudes to science is a long-term project that will not occur overnight - the effects will be seen in the long-term” (p. 7).

For this reason, Jansen acknowledges that the government should continue to encourage young people and mostly girls in STEM. Even though Jansen seems to be positive about the campaigns conducted by the VHTO organisation, she argues that it is necessary that these programmes continue to pay attention to girls. From her viewpoint, campaigns such as ‘Choose Exact’¹⁰ seem to be effective from the onset, since people will start paying attention to it and it is noticed that girls are more likely to choose a study in the STEM field because of this campaign. However, this slight increase always instantly collapses after a short period of time (N. Jansen, personal interview, December 24, 2015).

The interviewee claims that the ‘Choose Exact’ campaign was not capable of achieving a structural increase of female students in this field of study because it was a ‘separate’ activity and it was not carried out on multiple levels (N. Jansen, personal interview, December 24, 2015). Booy et al. (2011) state that in the recent years, Dutch higher educational institutions became more aware that they cannot accomplish lasting change by a few separate activities, but they should rather opt for long-

¹⁰ The campaign ‘Choose Exact’ is described in chapter 4 (p.47).

term policy in this area. An example of a long-term policy is the 'VHTO approach,' which was carried out from 2004 until 2011 (Booy et al. 2011).

Jansen thinks that, as long as girls remain underrepresented in STEM with a percentage lower than 30 percent, special attention should be given to girls in STEM at every decision-making moment. The encouragement of girls to participate in STEM is an ongoing process. Therefore, it is only achievable if it is done for an extended period of time. Moreover, it is recommended that the Dutch government pays more attention to the diversity in educational structures and transition processes. In order to stimulate the process of fostering female enrolment in study programmes in the STEM field, the state should continue to provide grants to realise this. (N. Jansen, personal interview, December 24, 2015)

5.5 Conclusion

In this chapter, it has been found that Dutch culture held women back from participating in the STEM fields of study in several manners. This problem seems to be mainly caused by the prevalence of gender stereotypes towards women in STEM seeing that it is assumed that fields such as sciences and engineering belong to men. According to Jansen, the 'breadwinner model' in the Netherlands, which lasted until the 1980s, contributed to this stereotype. It has long been considered as normal in Dutch society that women stay at home and are dependent upon the incomes of their husbands. (N.Jansen, personal interview, December 24, 2015). The fact that most women currently work part-time does not help to enhance more women in the STEM field because most jobs in this field are full-time. Subsequently, the low participation of women in the STEM sector leads to fewer role models available in this field.

Government initiatives in the Netherlands aim to change social views to reduce the gender gap in STEM. It seems to be difficult to successfully implement these initiatives in the education system since Dutch society is still considered as gender-traditional. That is to say, affordable childcare and equally distributed parental leave have not been realised yet in the Netherlands. Moreover, the low female representation in STEM can be explained by including cultural factors, since many Dutch women perceive working in the STEM field as difficult and unpleasant (Booy et al. 2011).

In conclusion, Dutch culture needs to be changed in furtherance of reducing the gender gap in the STEM study programmes in higher education. Legislation and positive actions alone will not necessarily lead to gender equality in the STEM fields of study (CDEG, 2011). The World Bank thinks

that this process can be fostered when measures are taken within the education system as well as in society. According to Sandström, this is not easily done. The whole of Dutch society should be included in achieving greater gender equality across study fields in higher education.

Conclusion

When it comes to the participation of women in higher education, there is little difference between Sweden and the Netherlands at first glance. In both countries, there are even more women than men enrolled in tertiary education. However, there remains a less noticeable gap in these countries, namely the gender gap concerning the participation of students in the STEM fields of study in higher education. In respect to this 'hidden gender gap', the Netherlands are lagging behind compared to Sweden. In 2012, the percentage of female students enrolled in the STEM field was 36 percent in Sweden, while the Netherlands only represented 21 percent of women in this field.

One of the reasons for this disparity are the differences in measures in the field of education. An important measure in Sweden, for example, was the implementation of a pre-university programme in 1992 to get male and female students back in the STEM track. Later on, a variety of campaigns which aim to encourage girls and women to choose a study programme in the field of STEM were carried out in Sweden. More recently, a gender-neutral pre-school has been introduced.

Likewise, Dutch policy makers have taken a variety of efforts to counteract gender stereotyping in higher education nationally. The Dutch government does not seem to be underperforming compared to Sweden in implementing campaigns and other strategies to address this matter. However, the Dutch campaigns to promote STEM among girls and women have not led to a significant increase of women in these fields of study.

The differences in the outcomes of Swedish and Dutch policy measures are mainly related to cultural divergences between both countries. Dutch culture is still dominated by gender stereotypes with respect to women in the STEM sector. In the Netherlands, it is still often assumed that fields such as sciences and engineering belong to men. This is primarily due to the long lasting existence of gender traditional role patterns that largely arise from prolonged dominance of religious parties in the Netherlands. These political parties have maintained the so-called 'breadwinner model' for a long time. The latter explains the unequal distribution of parental leave and expensive childcare, which are factors that contribute to the shortage of women in STEM jobs. Additionally, Dutch women dominate part-time jobs, while most jobs in the STEM sector are often demanding and mainly full time. Arising from the prevalence of gender traditional roles, many

Dutch women perceive STEM jobs as difficult and boring and therefore unpleasant. As a result, there are few women working in the STEM sector who can serve as a role model for girls in education.

Similar to the Netherlands, the Swedish government has been actively involved in reducing gender gaps for decades. Apparently, the circumstances in Sweden at the time also offered better opportunities to do so. In contrast to many other European countries, the Swedish government was able to effectively approach challenges of industrialisation at an early stage. Social democrats have dominated Swedish politics since the 1960s and these parties created one of the most generous welfare states of the world. The Swedish welfare state contributes to greater gender equality and equal rights for men and women are highly valued by these parties. The introduction of the welfare state has contributed significantly to greater gender equality. This strive for equality played an important role during the building up of the Swedish welfare state. Currently, the distribution of work between women and men is balanced in Sweden, an equal distribution of parental leave is implemented in their policies and there are low costs for childcare. These factors lower the threshold for women to participate in the STEM sector and led to more role models available for girls and women.

Based on these findings, it can be concluded that the core of the problem of the hidden gender gap in higher education is caused by cultural factors, in this case the pervasiveness of gender stereotypes. Therefore, it is particularly important to eliminate the causes of these stereotypes. In addition, specific measures should be taken to counteract gender gaps across study fields. These measures will be addressed in the recommendations.

Recommendations

Based on the conclusion, the following recommendations are provided. The Dutch knowledge-based economy, specifically the STEM sector, could benefit from these recommendations. Moreover, the promotion of gender equality across study fields enriches the opportunities and choices of female as well as male students. As described in the conclusion, gender stereotyping remains the greatest obstacle to the elimination of gender gaps in the fields of STEM.

In order to move toward the Swedish standards of gender equality, the Netherlands has to exert tremendous efforts through campaigning and other initiatives to reduce gender gaps across STEM study fields. Simultaneously, Dutch policy makers should make certain that the whole of the society is involved in this process. Single, specifically STEM-oriented initiatives will not result in substantial growth in the female enrolment in the STEM fields of study in the Netherlands. Only when the whole of Dutch society becomes aware of the fact that gender stereotyping continues to occur in many areas, there may arise conditions to ensure the success of the specific measures to reduce gender gaps across STEM study fields.

Secondly, more female role models working in the STEM fields should become available for girls and women in all education levels. The provision of more role models can be stimulated by the Dutch government. It is recommended that Dutch policy makers accomplish the extension of parental leave and cheaper childcare to make it more accessible for parents to divide work equally among themselves. In doing so, the distribution of work between men and women in Dutch society will become more equal. These changes will lower the threshold for women to participate in a job in the STEM sector that is often full time and demanding. In turn, the increased share of women in the STEM sector can serve as potential role models.

Thirdly, it is recommended that the Dutch government pays more attention to the process of the implementation of the gender mainstreaming strategy at all educational levels. Only when the strategy is properly assessed and recognised, it could serve to make teachers and other stakeholders in the educational settings aware of the importance of gender neutral teaching. In doing so, teachers will gain the competence to encourage their students to explore their talents and interests without limiting themselves on the basis of their gender (CDEG, 2011). Simultaneously, gender mainstreaming might decrease gender stereotyping among teachers in the

Netherlands. In doing so, this strategy has the competence to provide for the achievement of more gender balance in study programmes in the STEM fields.

As last, an initiative that seems to be efficient is the introduction of study programmes that are not entirely composed of science and technology but also involves segments from other disciplines, for instance the degree programme biotechnology. Studies have shown that a wider range of study programmes in the field of STEM in tertiary education appears to be appealing to female students in the Netherlands.¹¹ Therefore, it is suggested that the Dutch government continues to introduce attractive study programmes that involve STEM courses to some extent (Booy et al. 2011).

¹¹ More information on this initiative is provided in *Trendanalyse: gender in het bèta/technisch hoger onderwijs* by Booy et al. (2011).

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Appendices

Interview transcript: Jansen

On December 24, 2015, an interview has been conducted with Noortje Jansen, who is a policy officer VHTO, the Dutch national expert organisation on girls/women and science/technology. This organisation is situated in Amsterdam, the Netherlands. The tasks of her position mainly comprises the management of expertise. She makes sure that the expertise of her fellow workers, including her own knowledge are up to date. Furthermore, she has been maintaining two websites called 'ditdoeik' and 'gender & STEM.' 'Ditdoeik' is mainly focused on role models, which are the most important trademark of VHTO. Gender & STEM is an international network with several researchers who are conducting research in this particular area. Originally, the interview was conducted in Dutch. In order to make the information suitable for every reader, this interview has been translated. The letter I refers to the interviewer, who is the author of this report, while the letter R signifies the person who was interviewed, the respondent. The duration of the interview was 47.59 minutes.

I-1: The consent form is supposed to be signed by hand, I hope this is not a problem for you?

R-1: I could ask if my partner could send me a scan or a photo from his office.

I-2: What is your function at VHTO and could you tell me about the main goals of this organisation?

R-2: I can tell you that. I'm a policy officer at VHTO and that would actually mean that I'm mainly busy with the management of expertise. That encompasses that I make sure that the expertise of the fellow workers remains up to date, including my own expertise. Furthermore, I have been maintaining a website called 'ditdoeik.' This is likely to change in the future but for now, it's mainly focused on role models. Those are our most important trademark. Women and men who are participating in the STEM fields of study and women and men who are working in the STEM field represent these role models. The website is mainly intended to counter gender stereotypes- mostly stereotypes in occupations in the STEM field. Additionally, I maintain the network 'gender & STEM,' which is an international network with all kinds of researchers who are doing research on this particular area. This network hold biannual conferences.

I-3: Are those conferences being held in Europe?

R-3: Yes, most of the times they take place in Europe. However, there are many Americans working in this network and I am actually collaborating with an Australian researcher. Since we're operating in the Netherlands, it is more convenient to hold the conferences in Europe. This year, the conference will take place in Newcastle. In addition, I do a lot of things in between.

I-4: Okay. I think that VHTO is the perfect source of information in order to answer the research question of my thesis.

R-4: That is what we were thinking too.

I-5: The second question is as follows: I saw that you collaborated on a book on gender in STEM in higher education. In this book, I read that in 2009, the Netherlands had one of the lowest percentages of women in the STEM fields of study. How did that happen?

R-5: That is a question that is being asked a lot, and the answer on this question could always be explained by elaborating on the impact of the vicious circle in this matter. When only a small number of women participate in the STEM fields of study, it might be caused by the fact that there are only a few role models. I think that because of that, sex stereotyping remains strong. This phenomenon will lead to less women in STEM. How did that happen, you would think?

We (VHTO) think that an important cause of this situation is that the Netherlands originally had a household model, created by the Christian Party. This meant that women didn't work. This culture has remained for quite a long time. Still, women in the Netherlands are likely to choose for an educational career which they enjoy, instead of opting for an educational career with which they are most likely to find a job. This is being stimulated by their parents and teachers in schools in this manner. Moreover, we always explain a number of general requests.

Firstly, girls tend to be less confident regarding their skills in STEM subjects. This starts already really early, this difference. In the Netherlands, it starts extremely early. When compared to the performances of boys, girls perform fairly equal. It depends a bit on the skills you look at. Some boys perform better on particular subjects than girls. However, in general, girls and boys score about the same. When looking at the self-confidence of girls concerning their skills in STEM, it turns out that the confidence of girls is a lot lower compared to that of the boys.

Furthermore, boys overestimate their skills in the STEM subjects. Girls are underestimating their skills extremely. Yet, boys overestimate their competences fairly. You could imagine that teachers and parents are likely to base their advice on this when they help their children in deciding what

courses to take in secondary education. The stereotyped views of the parents on what is a 'girls thing' and what is a 'boys thing' adds to that. However, this stereotyped view is being held by children from an early age. All those factors- I am always into the nuanced answers- but you can notice that it is not just one 'thing' that is happening.

There is the gender stereotyping, this means that STEM is a 'boys thing.' Then there are the stereotypes in occupations and functions. This controls the idea that, for example, a technician always has to 'build something.' Think of a car mechanic, for example.

When you ask an arbitrary girl to name an occupation in the STEM sector, she would name a car mechanic, perhaps an ICT professional nowadays, or a laboratorial worker. She would name a number of these very specific STEM occupations. Examples of occupations in STEM such as water manager or civil technician, you would hear them less often, while there are a lot of interesting functions to be found there. These functions are also very applicable to be prosecuted by girls.

In conclusion, the self-confidence of girls plays a big role. As last, the influence of parents and teachers who work less stimulating concerning the stimulation of girls in the field of STEM. When looking at these three factors, the main problem to be analysed is the lack of role models.

I-6: Okay, so the lack of role models is very important. Do you think that this might have to do with the Dutch education system? A short while ago, I read that in the Netherlands, youngsters are obliged to opt for a specific course pack which determines their freedom in deciding what to study in higher education. Could you tell me something more about the situation of Sweden in this matter?

R-6: I do agree that the fact that pupils are obliged to choose for specific subjects in secondary school has a lot of influence on the youngsters in deciding what to study in higher education. To be honest, I don't know much about the situation in Sweden. I'll have to look it up.

I-7: According to Eurostat, the percentage of women in STEM studies was very low in 2009. Has this percentage increased or decreased the last couple of years? What are the causes of this change?

R-7: The three factors I just told you about will always come back. Naturally, more insights have been introduced in how to influence certain factors. For instance, the mind set research is very popular nowadays. The mind set research implies that the self-confidence of pupils can be influenced by teaching them the 'growth mind set.' This means that you can improve things or change choices by learning boys and girls that by working hard, you can become good at subjects

from which you would think you are not good at it, simply explained. As I said, the mind set research is very important. There is a lot of commotion over this project, since a lot is being said about biological causes. This is a little complicated, since it is the story of who came first. There is one important researcher, named Jacklyn Eccles.

I-8: I've heard of her.

R-8: I don't doubt that. She did a research on the lifecycle of all faces of the life of boys and girls. In the outcomes of this research, you can see that from early childhood, experiences are being collected. These experiences lead to the fact that girls learn less skills in STEM courses from early childhood. Simultaneously, girls are being drifted away from choosing STEM courses from early on. Eccles argued that in most cases, this is a choice which has to be well substantiated, and it has been stimulated by the parents. The brains of boys and girls keep developing for a long time. For the boys, the development of the brains stops around the year 26. For girls, it stops a little earlier around the year 22. They develop under influence of the experiences that you possess. Where it comes from? Well, this is how we should do it. There are a few skills on which boys score better by definition, such as spatial awareness.

I-9: So that basically has nothing to do with the experiences, boys are just biologically better at it?

R-9: Well, that has to do with a sort of basis. It is proven that it is caused by the lack of testosterone in the uterus, in which boys completely drown (that is: the testosterone) and girls don't. It could possibly be a factor which has impact on the development of spatial awareness. Notwithstanding, there are a lot of doubts on the research that has been done on this issue. Most importantly, we should ask ourselves how to interpret these differences. We always say (that is: the organisation of VHTO): well, these differences do exist. However, whether you look inside the group of girls or inside the group of boys, you can notice that the average differences between girls and boys are considerably smaller than the mutual differences between the boys or girls. So within this group of girls, there are a lot of girls with a good spatial awareness. Yet, on average, girls perform worse than boys concerning their spatial awareness skills.

I-10: You're saying that this phenomenon is also caused by the fact that these girls are being stimulated less than boys?

R-10: Well, again that leads to the story of who was there first. Where does it start off with? Does it start with the stimulation, or is it actually already existing? Anyways, it should be made clear that

children should be stimulated into not- stereotyped things. That does not necessarily mean that girls should exclusively play with cars and girls with Barbie's. It is mostly about the running games.

I-11: In Sweden, there is a primary school called 'equality.' In this school, children are not named tot their gender, so no he and she, only 'hen.' This is a genderless pronoun. The toys are also gender neutral.

R-11: I think those are positive developments. However, it should be taken into consideration that despite putting your children on those schools, there are chances on gender segregation. The media is still blowing things out of proportion concerning gender roles. Nonetheless, parents who put their children on these kinds of schools are making positive progress. Yet, there are the influences from the outside that play an important role. However, this would be a very interesting solution to the very early gender-segregation, but this should also be stimulated strongly by the parents and teachers.

I-12: Do you think that these equality schools would succeed in the Netherlands as well?

R-12: Yes. However, this is not the only thing that we should work on. Stimulating gender consciousness for professors in higher education, but also for teachers in primary schools would be an important policy measure, I would say.

I-13: Do you think I should skip the questions on Sweden, since there are only 3?

R-13: You mean this one? Why does Sweden have a high number of women in STEM studies, compared to the Netherlands? Well, that can be caused by several different factors. It could be caused by the fact that the educational system is different in these countries. If the choice is being postponed, that might have a positive impact on the choices that are made by the pupils in what to study. In the Netherlands, the pupils are obliged to choose subjects at an extremely early age. You could find out more about that by yourself. Moreover, in Sweden there are more women active in the labour market and breadwinners. The care for the children is divided more equally. This probably has a lot of influence on how important a job is considered and how important it is found to do something that fits with your capacities and talents. So yes, I do think that that is an interesting one. Maybe they originally have less gender stereotyping in STEM.

I-14: The laws on gender equality that have been implemented in Sweden, such as the equality primary school, would it have effect on the Netherlands?

R-14: When you implement this kind of law, you should still worry about the fact that teachers should be trained professionally in becoming gender awareness or rather gender unawareness. In the Netherlands, teachers do not realise it themselves whenever they treat boys and girls differently. We have seen that by ourselves in film fragments of them teaching. When they saw the videos themselves, they were amazed that they would hold this stereotypical view in such an early stage. Therefore, it is important that the teachers are aware of this themselves. The same applies to secondary education.

Most people think that girls are hardworking. A 7 will be interpreted differently for girls than it will be interpreted for boys. A girl already worked so hard so if she would choose for a package of STEM courses, she would have to work even harder: she would never make it. Most people think that boys who get a 7 for a STEM subject just need to work a little harder and they would definitely make it. Pupils with a 7 should be treated the same. For instance, you should advise them to choose subjects in the field of culture and society, autonomous from the gender. In fact, you never know who worked harder.

I-15: So you are saying that it is a stereotype that girls are always the hard workers and boys just possess the competences to perform well in STEM.

R-15: Girls are hardworking, boys are just talented. That's the idea. Teachers recognise this too, when you tell them this. That is difficult for them to face.

I-16: Which policy measures in the Netherlands were effective concerning their ability to stimulate girls to opt for a study in the STEM field?

R-16: The answer to this question is complicated. I think you are aiming at government campaigns, aren't you?

I-17: Yes, that is what I mean.

R-17: Campaigns, such as 'kies exact' (Choose Exact) are slightly effective at start, since people will start paying attention to it. You will notice that girls are more likely to choose to study in the STEM field. However, this always collapses really quickly. Therefore, it is important that if you want to reach this, when girls are still in the minority in these kind of studies, to pay special attention to girls. In whatever way possible. This means that this special attention should already be paid to girls from early age, in primary education, or even in day care. Gender stereotypes are already very strong in day care. We should actually have gender-neutral day care in the Netherlands.

Starting from an early age is very important. Gender awareness for teachers is just as important as providing a lot of role models. In my opinion, the best policy measure of the Dutch government has been the subsidies that have been given to VHTO. This way, extra attention has been paid to this problem. There are more organisations that are occupied with this subject. These are more focused on single events though. It is more striking to address this issue integral. Consequently, in all types of education and even the whole path leading to business, should all become involved.

I-18: Have international initiatives, mostly EU initiatives with the aim to increase the participation of women in STEM in higher education had a big effect on the Netherlands?

R-18: If there is attention for this issue in Europe, that means attention will be paid to this issue in the Netherlands. This is one of the main causes why the Dutch 'Platform beta techniek'* has been established as a part of a European programme. I think it was the case that on a European level, more people in general were supposed to choose for STEM in higher education. This means an increase of girls AND boys was needed. Actually, the attention was only focused on boys, since that is considered normal. After that, platform beta techniek has strongly involved VHTO with our policy plan. This means that schools had a package of policy measures to choose from. Thereby, they were able to choose for the 'VHTO approach.' A lot of schools did that. Mostly in secondary education, you notice that a lot more girls started choosing for STEM subjects, in particular the schools where VHTO has operated. However, the question is if this is caused by the schools that were already more aware of the gender segregation, or the contribution that we have made. I suppose it is caused by both factors.

I-19: You mean that the schools who choose for the VHTO approach were already aware of the problem, so they were already working on it.

R-19: Yes, because else they would have never chosen for these subjects, if they wouldn't find it important. You should always take that into account. It is always of importance to tackle the issue from different angles. It did pay off though. The biggest problem is in the transition from high school to university. A lot of girls still choose for a different direction in this transition.

I-20: Do they do this despite the fact that they choose for the STEM subjects in secondary school?

R-20: Yes, it is of luck that for medicine, you need to have science in your package of subjects. That is the main reason why many girls chose for a double profile (science and health and science and technology). Yet, when they are invited to study medicines, they eventually choose to study law or something like that. That's a pity, since they do have the capacities to study medicines. There is still

much to be achieved in this area. I mostly focus on higher education, since it is relatively easy to analyse compared to other types of education.

I-21: That is okay, since I focus on students in higher education. Do you think that the initiatives of the EU to foster gender equality in higher education are as effective in Sweden as they are in the Netherlands?

R-21: It depends on the measure they undertake. When looking at Europe, some initiatives have been taken in Brussels and there are also conferences being held there, called gender summits. However, not that much is being done on European level. They do work on initiatives to foster gender equality but they do not focus on gender equality in STEM. I can imagine that in Sweden, these measures for gender equality are already introduced and therefore, measures that are taken specifically in STEM, might succeed faster.

I-22: Do you think that the countries (Netherlands and Sweden) would stick to the laws better if they are implemented on European level or on a national level?

R-22: Well, that is hard to say. It depends on how European- minded they are. Basically, I think that it really helps when Europe notifies these issues, mostly because it means that money will be released. Of course, money is always an important factor.

I-23: You are saying that it depends if the policy is more effective when implemented in Europe or in their own country?

R-23: Yes, it depends. These measures are always free to interpret and it just depends on how you reflect these measures in your own society or education system, but also how you are going to carry them out. Of course, the effect of the measure is always different from the measure itself. So yes, it depends on these factors. I'm not sure if Sweden has the same organisation as VHTO, but I think it helps really strongly when you have national initiatives on that area where smaller organisations can possibly join later on. This will make them more capable to succeed. In America, They also have a lot of national organisations which focus on gender and STEM.

I-24: Do you believe that European policy measures are capable of countering sex stereotypes or is it more of a cultural aspect?

R-24: Yes, from very recent research, you might have found it yourself, from David Miller, it has been found that gender stereotypes concerning STEM are very strong in the Netherlands. Gender

stereotyping in general is not a problem, since the Netherlands is doing really well on all kinds of other emancipatory factors. However, gender stereotyping concerning STEM is very vivid in the Netherlands. For this reason, you could say that it is a cultural aspect. However, you can deduce directly from this that girls are 'not made' to succeed in STEM subjects. We experience this a lot, whenever we visit schools, the teachers tell us: yes but girls do not even want to specialise in STEM and they are not able to do it anyway. However, when we can show them that it is happening in other European countries, it makes our argument more valuable. The fact that it is a cultural aspect in the Netherlands, means that in reality, it is possible. Yet, this gender stereotyping is a very strong cultural aspect in the Netherlands. Much stronger than in several other countries. It is questionable if European initiatives are capable of counteracting this gender stereotyping.

I-25: I would think that it is difficult to achieve, since the culture is different in every country.

R-25: Yes, but I do think that we are internationalising and globalising a lot more nowadays. If more role models become available, by this I mean mostly role models on a 'normal level,' so not just the Cheryl Sandburgs, all the women who function on this level. I aim for the 'normal women' who are just doing their job at the STEM businesses, and who are doing it right and actually enjoy it. I think that is the most important to demonstrate, because the identification is most essential in achieving this. Every arbitrary girl should be able to identify with this kind of woman. We should take into account that not every girl has the ambition to become a top woman. Nonetheless, it is a positive thing to show them that it is possible. Showing off normal people as role models, is also really important. That can cross the boundaries of all cultures.

I-26: Those kind of initiatives really do have influence on the culture in the Netherlands, don't they?

R-26: Yes, I think it does.

I-27: This question was actually not in the list I sent you, but a short while ago, I read something about a project of the European Union. The project is named: science, it's a girls thing. Have you heard of it?

R-27: There has been a lot of criticism towards that project.

I-28: I would like to ask you for your opinion on this matter?

R-28: It just didn't turn out as it was supposed to. They put down science as a gender stereotype. While it was supposed to show how broad this subject area actually is. And they should explain that

that is possible, being a woman. They should have showed that. Yet, they turned the commercial into a 'high heels make up party.' That is not how I would do it, but yeah.

I-29: That is not really helpful for the girls who are not that feminine, I would say.

R-29: Exactly. It is all about the role models. You should show the girls who do it and mostly; what there is to do. There are so many different kinds of STEM and because of that, it is hard for the boys and girls to realise that they are able to find something that suits them. However, for boys it is less hard, since it is considered normal for them to choose for a study in the field of STEM, even though they don't actually know what it contains. Girls, for that matter, are much more critical. So we should continue with showing them how many different options there are in STEM. That is more important than showing them how 'feminine' STEM can be. Who does it and how does it happen, those are really important things to demonstrate.

I-30: So you're saying you find it most important that more role models are becoming available?

R-30: Well, that's what I think the EU was aiming at with 'science, it's a girls thing.' They wanted to show them that science is also interesting for girls. In that respect, I agree with that. However, you can never bring about change with just one particular measure; you should always work on all different areas. This includes gender awareness; mainly the parents should be involved in this change. Parents have a lot of influence (albeit unconsciously) on the choices of the pupils, for or against STEM. So we should not just involve the academia in education, but also the parents. In addition, friends of the pupils and/or the classmates should be involved, and the boys as well. Boys are thinking in stereotypes way more than girls: it already starts in primary school.

I-31: You are saying that influences from the outside are almost most important?

R-31: Yes. We should also not forget to work on the confidence of the girls and the awareness on schools.

I-32: Yes. The confidence of girls is being influenced by the teachers, parents etcetera. Am I right?

R-23: Yes, but it is not an issue when a certain STEM course is hard, because girls are also capable of succeeding in difficult courses. However, it is noticed a lot that girls want to feel secure by knowing that they don't have to do it all on their own. As an example, I recently read in a research that a special day has been organised for girls. After that, measurements were made. It turned out that still, girls found science more difficult than they would've expected before. However, this information day increased the chance that girls would opt for science. This is caused by their feeling

of security; they know that they would not have to do this all on their own. They realised that they had the support to overcome difficult challenges.

I-24: So that made them more secure to choose for an educational career in this direction. Let's finish this off with the last question.

R-24: Do you have any recommendations which for the Dutch government? Do you mean this question?

I-25: That's the one.

R-25: I'm thinking that, as long as girls remain underrepresented in STEM with a percentage of lower than 30 percent, special attention should be paid to girls in STEM, in every decision-making moment. It's an ongoing process, so it can only be effective if we give attention to all these different forms of education and the moments of decision making. The government should continue stimulating this and continue to provide money to realise this. At the moment, you see that again, science courses are focused on boys. We ensured that the number of girls inscribed in science slightly increased. Nonetheless, it remains an important thing that has to be kept up to date.

I-26: You're saying that a lot of attention should be paid to this matter.

R-26: I recommend you to take a look at the 10 insights of the conference on higher education, which has been held in November. Furthermore, I am working on expanded leaflets which include these 10 insights. It's available on the website. I have to admit that it is not always easy to find this information. If you enter 'ten insights' in the search terms, you will definitely find the information. It's under 'higher education,' and then you should enter 'gender & STEM.' Then there are the programmes and there are the 10 insights. The expert views are also interesting to take a look at.

I-27: I can see it on the website now. I can also gain information from your book: gender in het beta/technisch onderwijs. I can do a lot with that too.

R-27: Okay, I think it is time to end this interview. Whenever you need references to research, you can send me an email.

I-28: That's okay, I'll probably put my thesis in the archive of Atria when it is finished.

R-28: I recommend you to put a version of your thesis at VHTO as well.

I-29: Would you like to see the interview transcript?

R-29: I would like that. This way, I can see if I did not say anything untrue. This is always a very sensitive subject, for this reason I would like to be on top of it for a bit. Sometimes it turns out that something is written out differently than the way I said it. I will check it on that ground. That is why I would like to see the transcript beforehand.

Interview transcript: De Jong

On January 15, 2016, the author of this report interviewed Doesjka de Jong, who is an employee at the International Office of the Faculty of Architecture and the Built Environment. This office is situated at the Technical University of Delft in the Netherlands. De Jong graduated in engineering at TU Delft herself. Currently, the tasks of her position encompass the guidance of the incoming exchange students. She makes sure that all accounts are settled and that they are registered. Moreover, she assesses the portfolios of the outgoing students who go abroad and determines to which countries they can go. In addition, she makes sure that the master students who come from abroad are assessed and registered. At the outset, this interview was held in Dutch since the interviewee has the Dutch nationality. For this report, a literal translation was modified in the pursuance of making the results of the interview accessible to every reader. The duration of the interview was 26.02 minutes.

I-1: I understood that you studied architecture at TU Delft. You are currently working at the International Office of the architecture faculty at TU Delft. Could you tell me about the tasks that you perform in this position?

R-1: I guide the incoming exchange students. I make sure that all accounts are settled and that they are registered. Then we also have the outgoing students who go abroad. We also need to assess the portfolios and determinate to which countries they can go. Furthermore, we have our master students who come from abroad and need to be assessed and registered. An introduction day must be arranged and we also have to answer questions.

I-2: Did the experiences that you gained during your study programme contribute to this position? Since I assume this occupation is slightly different than the courses you studied.

R-2: Well, the choice to work here is directly linked to the fact that I studied architecture at TU Delft.

I-3: Okay, I understand that.

R-3: Surely, it does help that I substantively know how this study programme works. A lot of things have changed however, since the time I studied here. It does help since I substantively know what it is about.

I-4: Do you remember what the distribution between women and men was like in your academic year of engineering?

I-5: From your point of view, why do you think there was an even number of men and women in engineering compared to the other STEM programmes?

R-5: Engineering is a lot less 'technical oriented' compared to all the other study programmes here at TU Delft. It depends, of course, which direction you choose. You can choose to specialise in the direction of architecture and engineering. This means that a lot of engineering is involved in your study programme. If you just study architecture or landscape architecture or urban design, you will.. yet these are very different facets.

I-6: Which study profile did you opt for in secondary school and why?

R-6: I choose to study STEM subjects since in my time, the study profiles available were either the languages and humanities or the STEM subjects. I chose for STEM because it provided for more possibilities than the humanities direction. I actually wanted to study veterinary medicine, but it turned out that my grades were too low. Therefore, I did not even try to enrol for this study programme.

I-7: Did your parents, teacher or other external influences stimulate you to choose for this study profile?

R-7: My parents did indeed stimulate me tremendously. Apparently, the teacher did not stimulate me at all according to my parents.

I-8: Why did you think it was like that? Why didn't your teachers stimulate you?

R-8: I was not good enough. I was in gymnasium. Half of my class consisted of very intelligent pupils. The teacher did not find it necessary to guide me or help me through. Without extra explanation, I was not able to succeed but the other half did. I just needed some more explanation. However, I finally succeeded. They just could not care to put some extra effort in it and therefore they wanted me to do humanities.

I-9: Were there a lot of girls in the STEM courses of the academic year in your high school?

R-9: Yes, there were quite a lot of girls in the STEM courses of my academic year.

I-10: Why did you decide to choose for the engineering study programme? Did your parents, teachers or other people in your environment stimulate you to study in this field?

R-10: I really enjoyed drawing and arts and crafts and being artistically engaged. I definitely enjoyed my study programme because it was very artistically engaged. Since I initially applied for veterinary science and was able to enrol for engineering, I could go there. My teachers did not interfere with my study choice at all. My parents supported me though. However, it was my own decision.

I-11: So it was not the case that you needed higher grades for certain subjects in order to be accepted for engineering. I would think that you need to have completed STEM subjects first.

R-11: Indeed, you are obliged to have passed 'Mathematics B'* and science.

I-12: Does that mean that you were already good at STEM subjects before you opted for the STEM study profile?

R-12: No, I was not particularly good at any subject. I think I was evenly good at each subject. I once did an assessment which showed that it would be more wise to not choose for languages. Planning and spatial awareness were more of my qualities. I think the assessment has to do with the experiences you gained.

I-14: Are you familiar with gender stereotypes and how it influences pupils in deciding what to study in the transition from high school to university?

R-14: I was not very aware of this beforehand. I think this is caused by the fact that I don't care at all about what people think of me. I am just weird that way. However, it does stand out. I studied here and lived in a student apartment in Delft. 2 out of 10 students were girls. So yes, there are indeed a lot less girls compared to the number of boys.

I-15: Were you affected by these stereotypes or at least conscious of the fact that this happens?

R-15: I am aware of it but my parents are very progressive. The duties division was very different than usual. My father cooked, ironed and took care of the house holding alongside his job. My mother worked fulltime. In my time that was very differently from the average classmate of mine.

I-16: Do you believe that a distinction could be made between 'male studies' and 'female studies'? We often consider languages, sociology and psychology to be female studies.

R-16: I suppose that you are right. In Leiden, there are indeed a lot of women in these kind of study programmes. In Delft there are mostly men. I also think that economics are largely occupied by men..banks... financial sector. I suppose there will be a lot of men.

I-17: Do you believe yourself that male studies are dedicated to men because they are better at STEM courses and girls are better at humanities and languages?

R-17: No, I don't believe that. I think it mostly has to do with the distribution of roles between men and women in the Netherlands. A lot is being expected from women. Even from me.. I spend a lot of time looking after my children. That is the reason why I don't work as much as my husband. We actually decided to divide our tasks 50/50. Eventually, this did not work out. Thus, it is not accepted when men want to work less hours. Pregnancy leave for men is only for 2 days in the Netherlands. As long as no changes are being made, it remains difficult for women to get a serious job to which they commit themselves for the full 100 percent. Decisions have to be made. It does not just have to do with gender but also with the roles which are being distributed by society. In the Netherlands, it is expected from women to care for the children. You either have to decide to get children or you should have a husband who looks after them or the nursery schools should be well arranged.

Nowadays, you still need to be at home before 6 to pick up your child from the nursery schools. This means that this will not work out when you have a regular job with longer working hours.

I-19: the Netherlands has the biggest number of women in part time jobs compared to the other European countries. You could say that this is sort of a culture.

R-19: Yes, on the other hand, this could be positive. There are pros and cons.

I-20: You could say that it gives women a lot of freedom. So I assume that you think that the gender differences remain vivid in the Netherlands due to our culture.

R-20: Yes indeed.

I-21: So you do not think it is due to the performances of men and women in particular subjects?

R-21: No. However, it has to do with the interests of the woman, I think that they would choose these subjects if they were actually interested in them. Because eventually, we all have the possibility to choose for the subjects that we want. I think it is also determined by their way of thinking: that is not really necessary. It is also caused by the examples they get.

I-22: Are you aware of the fact that the Netherlands has one of the lowest percentages of women participating in STEM study programmes, compared with all the other EU countries?

I-23: I was not aware of this.

I-23: I made an overview of these results. In Sweden, 42 percent of women in science, mathematics and computing. The Netherlands has one of the lowest percentages as opposed to the EU average.

R-24: I figured that in the Netherlands, the low percentage of students would be in science. I am aware of the campaigns which are aiming for more people in science. Naturally, they have been trying to get more girls in science for years. Why would that be? I don't really know. In my experience, many classmates just preferred languages and humanities because they really enjoyed it and were not competent enough in STEM subjects. That is the weird thing about interest. They

were just as competent in languages as they were in, say, science. I have also had classmates who did both, but in many cases, they eventually decided to study languages and/or humanities.

I-24: The Dutch government did a lot to increase the number of women STEM studies. However, this did not lead to tremendous changes. The number of women in STEM does increase very slowly though. Which factors stimulates women to enrol for a study in the STEM sector? For instance, do you believe that there should be more role models in education such as female teachers who teach the pupils science. Do you think this will stimulate women to opt for this kind of study programme.

R-24: I think that you should start even earlier, in primary school. Nowadays, engineering is being provided for children in primary schools already. However, it does not mean much. I think that it should be brought under attention that girls start playing with Legos. All the commercials are being focused on girls who play with dolls and boys who play with cars. Naturally, it would help if the science teacher is a woman. However, it is more important, in my opinion, that the teacher is competent and provides good education. I think that is more important than the difference between male and female. You need someone who is actually excited to teach these classes.

I-25: I would also suggest that the teachers should be aware of gender stereotypes. This way, we can prevent teachers from telling girls to refrain from choosing STEM courses, just because she didn't perform so well. However, this was not the case for you I assume?

R-25: Well, I think it would be helpful if someone provides guidance instead of telling them to refrain themselves from these courses.

I-26: You are saying that both women and men should be stimulated and not exclusively women?

R-26: No, I think you should let them follow their own interests. Furthermore, whenever somebody is interested in a particular course and is willing to understand and ask for guidance, you should provide that to the pupils, regardless of their gender.

I-27: Okay, so regardless of their gender, there should be an even amount of attention spent on the pupils. I am assuming that you find competent teachers more important than role models.

In the Netherlands, girls and boys need to choose for their study profile already around the age of 15. This happens in their third academic school year. They are a little tied to this profile, since it influences them in deciding what to study.

R-27: I think that's very young. I think they are way too young to decide on this when they have the age of 13 or 14. When I was that age, I was not concerned with that at all. It all lasted very long in general for me before I... So yes, I think the pupils are too young to make a decision like that. It is better to keep it broad.

I-28: This is the case in Sweden.

R-28: I think that is much better.

I-29: It is not like they just need to opt for one specific study profile in Sweden. They are able to opt for a variety of courses and are able to change this later on or to drop a subject. Therefore, it is much broader there.

R-29: I think that is better. The education system used to be similar to this in the Netherlands in the past. In addition, you needed to do a course or study programme for a longer time.

I-30: Do you think that campaigns help to counter gender stereotypes such as 'kies exact'? It is mostly focused on girls. Do you think these kind of measures are helpful or not?

R-30: I don't think so. At least not for me, I am not that influential by advertisement so I am not at the right place to judge.

I-31: Do you think that governmental measures such as 'kies exact' are able to counter gender stereotypes? That means that it can bring changes in the culture when it is being stimulated long enough?

R-31: Well, I don't know. I think it helps, but you should not just address the children on this issue, but also the parents. Parents play a very important role in the decision-making of their children, I assume. I think that parents should inform their children already in primary school and high school on the variety of possibilities in choosing STEM studies. I just think that they should be better informed about the wide variety of STEM study programmes. Perhaps they could organise information markets for children as well. For instance, they invite people over to talk about their profession at my children's primary school.

I-32: Are there a lot of women in STEM occupations involved in this?

R-32: There are women and men involved in this and indeed also those who have an occupation in the STEM field.

I-33: I assume that this makes children more open-minded and gives them more clarity about the available options to consider in deciding what to study.

R-33: I personally think that a national campaign is less effective because it is too general. I'm thinking that these problems should be tackled up close. For instance, I think it is a good initiative that doing an internship in high school is currently mandatory, well at least a community internship. In addition, different kinds of internship places should be recommended to children. This way, they will find out what these occupations consist of. In order to make a valid decision, you should know what kind of tasks you will perform and what it consists of. At that age, you don't have a clue.

I-34: That makes children think like... my friends enjoy languages so I want to do languages too.

R-34: This is how my daughter perceives secondary school. So it is like: oh, many friends of mine are going to study there. Well, I want to study there too.

I-35: External influences are indeed very important. But it is quite extraordinary that you were not affected by your surroundings.

R-35: : Well yes, in this respect I really enjoy to do my own thing, so..

I-36: Well, I think that is positive. So you assume that it works better at a small scale than it does at national campaigns. You also think that guidance and information sessions targeted at children in primary schools are more effective than advertisements? For instance advertisements which demonstrate women in laboratories?

R-36: Yes but I think you will see that anyway, there is still a high amount of women who work in laboratories. Well, maybe it helps if you think like: oh, that is also a possibility. That kind of effect. But I am not sure if it actually has such a big influence on society.

I-37: There is also a commercial named: science, it's a girls thing. Are you familiar with that commercial? It has been published by the European Commission a few years ago. They demonstrated women in high heels wearing lipstick, so they were portrayed as feminine. They saw a man sitting at a table, performing something technical. The women decided to replace him. I assume that the hidden meaning was that even feminine women are capable of succeeding in a study in the STEM field. This commercial has been criticised by many people and for this reason it has been removed from the internet. What do you think about this commercial? Do you think it is needful to counter the stereotypical view towards women who study STEM.

R-37: You mean it is more of a 'male version'?

I-38 Precisely. Some people think that the STEM studies are not feminine enough.

R-38: It is mostly a problem that it is hard for women to reach the top. However, this does not solely apply to the STEM study programmes. In general, you don't see many in the top positions. Not just in STEM, but all positions. Since it is known that women earn lower salaries or that they regularly earn a lower salary than man, they should work on that. Furthermore, they should improve the childcare. It must be arranged more effectively and it should be made easier.

I-39: A friend of mine studied engineering and she had mostly guys in her class. She did not really like that and therefore decided to quit her study programme. Apparently, the male-domination of her engineering class did affect her.

R-39: That has never affected me. Where did she study?

I-40: In Haarlem.

R-40: I think it depends on the person. I think that you should be able to deal with it.

I-41: I am not sure if you are familiar with the situation in Sweden, but I would like to ask you if you think that the Netherlands can learn from Sweden? This is because Sweden is being successful in general with respect to the maintenance of gender equality.

R-41: Well, when I hear about pregnancy leave and those kind of things and also the fact that men are able to escape from their job for a year or so, I would think that the situation in Sweden is a lot better. Everything is divided more fairly. Here, in the Netherlands, the roles between women and man are not fairly districted.

I-42: So the most important reason that Sweden is caused by the childcare system?

R-42: Precisely.

I-43: And also the fact that there is already more gender equality in this country?

R-43: Yes that counts in any case. That it is possible and that it is being accepted. The fact that people can accept that it is that way. The fact that men can take half a year off and eventually are able to divide the tasks between women evenly.

I-44: So you think that it's important that it is already implemented in culture and that it is perceived as normal that men and women are both the breadwinners in the family or the relationship. Maybe it also helps that gender equality is already being stimulated in Sweden. Do you think that this 'genderless' education system can be implemented in the Netherlands as well? A primary school which ensures that no differences are being made between girls and boys, that does not name any differences. You could say that children in these schools barely know if they are a boy or a girl. That means that gender stereotypes are being tackled already from a young age; from the beginning.

R-44: I don't know how they tackle this issue but I do not stimulate my daughters to play with dolls or to dress up as princesses. Yet they do it anyway.

I-45: So gender stereotyping does not always derive from the upbringing.

R-45: No. Besides, I do not know how schools can counter gender stereotypes...I think that there is already equality- to some extent- in primary schools. My children's primary school has a construction table and all children are obliged to play with it. So they are trying. Eventually, in most cases it turns out that women prefer to play with the dolls but you also see a lot of boys who play with the dolls. But that is a whole other category.

I-46: So you think that everything would be fine if children would just be released to do what they enjoy.

R-46: At least in this primary school, it is being stimulated to a certain extent already. However, I think that the parents play the biggest role in this matter. I do believe that they are still very conservative. For instance, my brother's son is not allowed to wear pink shirts. Whenever he visits

me, he can wear pink clothes and he loves. So yes, I think it depends on the way the parents do their children's upbringing.

Interview transcript: Sandström

On January 29 2016, the author of this report interviewed Kristina Sandström, who is Head of Division Mechanical Engineering and Natural Sciences of University West in Trollhättan. The tasks of her position encompass the division of the department of engineering, mechanical engineering, industrial and business engineering. Moreover, Sandström takes care of the mathematicians and the 'pre-college' year for STEM. The duration of the interview was 42.16 minutes.

I-1: First of all I would like to thank you for participating in this interview.

R-1: No problem.

I-2: Did you read the interview questions already?

R-2: Yes I did. And a few of them I think will be quite easy to answer and a few of them will be a bit harder to answer. Let's see where it ends up, okay?

I-3: Okay. The first question is easy. Could you tell me about your position in the Engineering and Science Department and the tasks that you perform?

R-3: Yes. I am working as head of the division. The department is the department of engineering, and I have the mechanical engineering, industrial and business engineering. I also have mathematicians and I think what you are referring to is as I would call the 'pre-college year' for STEM, so to speak. So that's also within my division.

I-4: Do you mean the SciTech Basic Year?

R-4: Yeah.

I-5: Why did you decide to become Head of the Engineering and Science department? Were the experiences that you have gained during your studies relevant to this position?

R-5: I am not the head of the engineering and science department. That's my boss. I am head of the division. So there are four divisions in this department. Engineering is the department and I am within the divisions of this education.

I-6: So why did you decide to become head of the division of engineering?

R-6: I have been working for the university for quite long. So to me it was kind of a natural step, I wanted to do something else and I was trying new things. I have been working here at the University, I have been working here since 2001, so it was a natural step for me.

I-7: Did you also study STEM subjects in higher education?

R-7: I've been studying mechanical engineering, so I'm from engineering myself.

I-8: Okay, so then actually it already answers the question. My question was: were the experiences that you have gained during your studies relevant to this position?

R-8: In a way yes, of course. It's easier if you have an engineering background if you're going to hire people within engineering and also for engineering subjects. But also, you need to have the knowledge in project management so you need these skills also. So it's both, I would say. But on the other hand, you learn a lot of these things when you study engineering. Yes, I would say that my background fits.

I-9: So you also learned a lot of new things?

R-9: Oh yes, you do, you all the day. I mean, it's everything from doing rehab meetings with people who have been sick to deciding who should take which course this year so to speak. So it's everything, really.

I-10: Do you think that the measures by the Swedish government to reach greater gender equality in the STEM fields are of benefit to you? Do you think that these measures contributed to obtaining your position?

R-10: Yes I know that there has been quite a few initiatives to be able to make that happen, yes.

I-11: Do you think that these measures helped you to get your position or did they help to make you decide to study STEM courses?

R-11: You mean for myself? For my education? That it helped me for my education?

I-12: Yes, maybe you got guidance beforehand especially for girls to apply for STEM studies or did you decide it by yourself that you are more interested in that?

R-12: I wouldn't say that I decided that for myself, but it's...This is my own opinion. This is not really how I think it works. I think that in general, it's not really that uncommon that in Sweden, women go to engineering studies. It's not been that unusual, even before the government made efforts to

get more women into it. It was not a big thing to go into engineering as a woman, even when I was young. It's not like... for example, I work a lot with Germany. And when I go there, people go: oh, you're in engineering and you're a woman. I'm just like: yeah, sure, why? Or people go: oh, I'm happy for you and I go: oh, why? Because I'm a woman or what? I mean, in Sweden it's a non-issue.

I-13: So it's normal to you?

R-13: It is normal. It's not a huge thing and in a few of our engineering programmes we have 50/50 when it comes to men/women. When I started engineering I started with mechanical engineering in 1998, I think it were 110 students, so to speak. I think we were almost 40 percent women in that group in mechanical engineering. It's not unusual, so to speak.

I-14: I find it interesting because that's what I found when I was working on my dissertation. In the Netherlands, it's like 15 or maybe 20 percent women in STEM and in Sweden it's 40/60 percent or sometimes 50/50, so that's a really big difference.

R-14: Are there a lot of female teachers in the STEM fields of study at University West?

I-15: Yes, I actually don't have the exact figures but I can easily find them and send them to you if you want to. I can easily give you the figures for how we're, how our employees are mixed.

R-15: Okay, that would be really nice. I can answer that question later then.

I-16: I actually already know the answer of this question, but...

R-16: I mean, for example, in our management group, our dean was up until new year, because we have a system in Sweden that they can't sit for more than a certain amount in that position. So my dean was the female. In the late management group we are equal men/women.

I-17: What is the distribution between male and female students in the engineering and science classes at University West?

R-17: It depends on which course or which programme you're looking at. If you for example go to the course power and electrical engineering, then you have more male students. If you go to business engineering, you have almost the same, and if you go to land surveying, you have more women. So it depends on which programme you're looking at. But I could give you the actual numbers right now as well. That is for example the students that started this semester as well as last semester in 2015. I could give you the exact on how they are divided.

I-18: Okay, yes because it was really hard to find those figures. The last one I have is from 2011, so I think that will be good.

R-18: I can take a look into that, that wouldn't take too long for me to do that.

I-19: Are you aware of the fact that in Sweden, the number of female students enrolled in the STEM fields is high compared to other European countries? So not just the Netherlands, but also a lot of other countries.

R-19: Yes.

I-20: In your opinion, which factors have led to Sweden's success in this matter?

R-20: In a way I think it has to do with that there are.. I think you need to look at the system in general. We have no tuitions, for example. That's one reason. We have had that for a long time. It has been not only in Sweden in the STEM field, but in general there has been a gender equality in this country for a long time. It's never been a huge issue that women go to university and from there to go to the STEM field is not a big step. So of course there is still less women going to engineering or going to the STEM field in total. If you compare the figures with how many women that go into undergraduate studies, there are more female undergraduates than male. It kind of blends up in all parts of the system, so to speak. So that's one thing. But then, if you go for master studies, you will have an increased amount of men and then, if you go to a PhD, there will be more men than women and if you go for the professors, there would be more men than women. So in the undergraduates, you will have more men than women. You could say that these women go into something more 'female' like teaching or nursing or things like that but they also stop their academic career earlier, so that's something we need to work on. Because we don't have a problem getting women to higher studies, but we have a problem getting them to continue after undergraduate studies.

I-21: So they also don't continue into the masters in STEM?

R-21: They do, but there happens something; the number of men compared to the number of women increased. So there are more male going further, so to speak. Why that is so, we don't really know.

I-22: That might also mean that more men will finally get a career in STEM than women because they are higher educated.

R-22: Yeah exactly. If you go for a PhD you are more likely to have an academic career, so to speak.

I-23: Do you also think that it has to do with the subjects high school pupils can choose in high school? Because in the Netherlands, you already have to choose specific courses when you are 15 or something and I read that in Sweden, it is more broad. You can change your courses afterwards, and in the Netherlands that is not really possible. So do you think that is also a factor?

R-23: It can be. It can also be that you're actually... I mean there has been initiatives to encourage the interest in mathematics for example in the lower grades and I think that's more the reason why it's going better so to speak. I'm not sure what you're looking into but I mean you should see into that female students from early age actually do better in school than male students.

I-24: Do you mean in the STEM courses?

R-24: In everything. So their grades are better up to 9th grade and even in gymnasium, women more often have higher grades than the male students. Why this is true, I've never looked into it so I can't answer you but it is a fact so to speak and it could also be one ingredient that makes this, I'm not sure. But to answer your question, of course, the more knowledge you have, the more basic knowledge you have in chemistry, physics, biology and so on. Of course it helps you to choose other... I mean we have gymnasium, more like high school, and then you choose if you're going for natural sciences or if you're going to technical or more political sciences for example.

I-25: I read that in gymnasium you can choose like 18 different courses and then afterwards you have to specialise I think?

R-25: I would say that you choose a programme, and then, for instance if you go for political sciences in high school, or gymnasium, you go to gymnasium after your ninth grade. So when you're 16 you go to gymnasium. Then you go for- most likely – four years. And then you choose, if you go to political science or natural science or economics or if you want to go for more handcrafting things like building houses for example. This is not real in my area, but the idea is that... maybe you should ask someone else about that, but the idea is that everyone should have the same knowledge to be able to enter higher education. But also, if you're going for engineering, or engineering studies after, then you need to have a certain amount of mathematics and you need to have a certain amount of physics and so on and so on.

I-26: So you need that to be able to apply for higher educational studies. Okay, so it is kind of similar to the Netherlands.

R-26: It is, I think it's not that far from each other. But I think that you have to start choosing earlier but that's the only difference.

I-27: I read that Sweden is one of the first countries that introduced gender-neutral pre-schools. Do you think that these 'genderless' pre-schools contribute to the increased female enrolment in STEM in Sweden? Have you heard of these schools? Should these schools therefore be introduced in other countries as well and why?

R-27: I don't know, I mean I have two kids and both have been to preschool but I can't say I'm familiar with that. Yes, if the boys want to play with dolls of course they can do that, and if the girls want to play with legos, of course they can. So I'm not sure...

I-28: There are only a few, I think there's one it's called 'Egalia' and it's introduced in 2010 in Stockholm. It is indeed the idea that boys can play with girl toys and the other way around and also they have the word 'hen' so they don't say 'she' or 'he.'

R-28: There has also been a lot of discussion about this word because they have been doing studies that it's not really good to separate and you still should be able to have your gender so to speak. But I mean, since the 70s here, when I was young, you never made differences between boys and girls in that matter. I mean, if you wanted to play with Lego, you could. If you wanted to play with dolls if you're boy, I mean no one would raise an eyebrow, not at all, no-one. But if you go into H&M for example, and buy clothes, then you can see that there is a difference between girls clothes and boys clothes. So of course there are differences, we are not perfect.

I-29: Still, I think it's a lot better than in the Netherlands when you look at gender equality.

R-29: I think you need to look at it in a bigger perspective. I mean for example, here you have the same amount of time to divide your parental leave with your kids.

I-30: I thought the parental leave was longer in Sweden.

R-30: Yes, it's much longer, I mean we can be home up until two years. And also; you divide the time equally. So my husband was home, just as long as I was with the kids. So that's one difference. Another difference is that we have not as high rates for our kids to go to kindergarten as you have. For example, I pay for both my children each month around 100 euros for them to go to pre-school and for taking care afterwards. My kids, I drop them off at 8:30, and then I pick them up in the afternoon, around 4:45, so both me and my husband work fulltime. For you- I have a cousin living in the Netherlands so that's why I know this- I mean for you, if you leave your kids at kindergarten

you need to pay a ridiculous amount of money to do that. I think it's more than, or at least around 5000 euros a month.

I-31: I didn't know that.

R-31: Then you have the system that actually, you need to earn quite a lot as a woman. If you're going to benefit from not staying home and not taking care of the kids. There you have differences that actually make it more- I mean for me- I earn more than my husband. We both pay to keep our kids in kindergarten. All these things make it easier for me as a woman to be equal. So it's not only what we do at the universities, it's not only the sediments we have to make people, but it's an overall idea in the society. Of course, you can't look into everything but I think this is something you need to see or look at when you actually see that okay, it's easier for women and men to be equal here.

I-32: That is a really good one. But I do think that maybe girls that are like 14 or 15, I don't think they know about all those things yet. I think at that age the interest is the most important, and then later on they start to become more aware of that.

R-32: They don't know, but if you have role models, if you have people in your surroundings, if you have female role models that actually work as engineers, not as staying-home moms or working a few hours a day or something like that. Do you see the difference? My kids know that me as a female- I work in engineering, even if I'm not working at a University, I travel a lot, I do everything. That would be perhaps more a male thing to do in other countries in Europe. That's where you have a difference. Do you understand what I mean?

I-33: Yes.

R-33: So not only all the things but actually that you see females doing things that traditionally, in other countries, is a men's job, make them see it's normal. As you said, as 14 or 15 year old boy or girl, you perhaps don't even reflect on it, but it's a common thing. So therefore you would not raise an eyebrow and think: oh, is that a female here?

I-34: So that's the difference.

R-34: So that's normal there. If they are interested and it's normal for them, then it's really easy for them to choose, right?

I-35: Yeah.

R-35: For boys and girls.

I-36: Have you heard of the SciTech Basic Year Programme? Do you work within that programme as well?

R-36: Yes, it's in my division.

I-37: Do a lot of girls benefit from it? Because I understood that you get accepted into University if you complete that year.

R-37: If you complete that year, you are most likely to go into engineering studies, yes. The main thing is that they don't need to be enrolled in our university. They can just as well apply to any other university. So I can't do a complete follow-up on them. There are both men and women attending the programme. If you've done that, you can continue on engineering studies just as well as anyone.

I-38: Is the distribution between women and men equal in that programme?

R-38: I think it's a few more men but it's kind of equal. I can give you the numbers for that as well. I can give you the figures for that.

I-39: That is great. I read about it in a book from the OECD and they said that it seemed that female students benefited from it but there were no facts, so it was really vague for me.

R-39: That's the problem. I mean we can't really tell if it's better or if it's beneficial, I mean if you attend this programme, of course you learn a lot. I mean I did it myself, I took it and I think it's a good way to enter to university. If I don't separate men and women, I wouldn't say the people- the person that took this year are more likely to go through with their studies in the engineering level. So that's a general thing- even if you're a man or a woman- so to speak.

I-40: These students they were doing other courses beforehand, right? And then later on, they decided to go back?

R-40: Everyone who enters this programme needs to have finished gymnasium.

I-41: But not specifically the STEM subjects, right?

R-41: No, they could have done political science, or economics, or anything, but they need to have finished high school before they enter the programme.

I-42: Okay, it is finally clear to me.

R-42: Good, good, good.

I-43: Do you think that this programme should be implemented in universities in other European countries?

R-43: I think it's a good way to pick up people that actually want to change their study paths, so to speak. I think it's a good way. Again, I don't really separate men and women in this case. I think it's good for anyone and it's a good way to enter.. if you look at people that come from families that not traditionally go to university for example, I think it's good because it lowers the threshold to enter university, so to speak.

I-44: Do you think it will increase the number of women in STEM in university in the Netherlands?

R-44: I think it could but I think when you work with these kind of things..because when I started working on this university I worked with student recruitment. So I was out in high schools and spoke about university studies and STEM studies and so on. What I think is important is to be able to create more women or more persons to go to engineering studies in general. You need to start early. You need to start already in the 7th grade or in the 8th grade. You need to start in pre-school. You need to make them interested in what is this all about? What is happening? Why is it interesting? Why does a bridge work as it does? What happens with a bridge? Why is there a small gap on a bridge? Why is that? Yes, because the bridge needs to expand when it's warm weather. That's why it's so important to build a good bridge. You need the gap so it can expand for example. If you tell kids that when they are young, they will go curious, they will start thinking. This is what you need to do to encourage them. To be curious and to see that: this is fun, this is nice. We also had a huge national kind of quiz/game, like a sort of technical quiz for 8th grades.

I-45: What age are they?

R-45: They are like 14/15. So they come here and they have: it's a competition. So it's a really nice way to do it. You need to encourage them early because you can't do it in high school: then it's too late. You need to do it early. But you also need to have role models. That is one of the most important things. Role models can be both male and female. It needs to be someone that is interesting, that can make them see that this is nice, this is good. You need to start talking about mathematics, not like it's hard and it's difficult and all these kind of things. There are many small things you can do. You can actually encourage people to go into this field.

I-46: So you've actually also been a role model?

R-46: I hope so, I can't say I have been, but I hope that I at least for someone made a difference. I'm sorry, I don't know what happened there.

I-47: Me neither.

R-47: Maybe my network went down or something I'm not sure. I'm sorry.

I-48: It's okay.

R-48: What I was saying was: I can't say that I've been a role model but I hope I made a difference and that's why you work at a university: you want to make a difference. I mean, that's why you go to university. That's why you do these studies. You make a change. You level. You create a different kind of pattern in your life. That's why you go to university, at least to me.

I-49: Do you think that Sweden is moving forward concerning the achievement of greater gender equality in higher education?

R-49: I can't say that we do but I hope so. To me, it's more about making young people want to do something good with their lives. Make people to actually make a change in their lives. It doesn't matter if it's a male or female. But you know that education makes people less inclined to be hateful. You know that education make people be less inclined to just believe anything you write.

I-50: I think it makes you more open-minded as well.

R-50: I think it does, it should at least. Hopefully it does. I think most people that reach university think so.

I-51: Do you have any supplementary sources which provide information on Swedish measures that were successful in increasing the participation of women in the STEM fields of study?

R-51: They have done many things. For example, a few years ago there was this programme that was implemented in 1997-98 to 2000 to make it easy for people to change careers. It meant that if you entered a STEM programme in any kind, for example a Basic year or a college year, you would get a reduction in your student loan. So that was one way of doing it. And there have been a lot of initiatives for example: 'girls and natural science,' 'girls and techniques' and everything like that in the lower ages. So a lot of things have been done.

I-52: What kind of programmes were that? For example the 'girls and science'?

R-52: It could be anything. For summer school, we have been in a project that one of our science centre's here is in charge of. I think if you have the possibility you could speak to people there as well if you have the time. That could be beneficial for you, I mean we have a really good science centre in Trollhättan that works with actually trying to make young kids more interested in actual science and technique. There I think you can get a good answer and they know of effective ways in trying to get more females into higher education.

I-53: I think that only these measures in higher education will not be enough in the Netherlands, because it also has to do with parental leave and the division of work and that all these things add together.

R-53: It all adds up. It's a chain that you need. You need to change the entire society. It's not easily done, I'm not saying that. It's not as easy as go out in school and tell girls that: ooh, science and engineering is fun! That's not enough because you need to also show that it is. So you need to find these role models, of course you have good, interested young women that are in engineering. Take them. Show them. It's possible to do, but I think that you have that work to do in the Netherlands, but not only in the Netherlands, also in Germany and the surrounding countries.

I-54: A couple of years in a row, the Netherlands was the worst in Europe. They are not doing so well.

R-54: There are things to be done, yes.

I-55: So you have to start early to encourage girls to do STEM?

R-55: Yeah, I think so. Start early and it's important with good role models. I really believe in that.

I-56: I actually think I can use this information for my conclusion as well. Do you have any supplementary sources which provide information on Swedish measures that were successful in increasing the participation of women in the STEM fields of study?

R-56: I can look it up for you and I think I can send you a few links. I'm not sure if I'm able to find Swedish sources but I will try to find a few to give you some kind of knowledge.

I-57: It's really hard to find real facts and figures.

R-57: That's the thing because that's always the problem when you do these kind of initiatives because you can't really say that these girls or women would have chosen differently. It's hard to say that they choose it because of... so to speak. So that's why, because most often it's a mix of

things that makes you do something. Some people go: okay, I want to be a doctor and that's what I'm going to do and I have known that since I was 5 years old and you know those kind of things. But also: there could be a teacher. I had a great teacher when I went to gymnasium. He was lovely. Because I said I can't do anything in mathematics, I don't understand it because I started out at the technical programme and I was like: no, I don't understand the maths, and I don't understand physics and I don't understand chemistry. I don't understand it. He sat with me for three hours and he was like: okay, if you open the books Kristina, it will go fine. You will do fine. I was: no I don't understand it. And then he really believed in me.

I-58: So you also wanted to get better at it, right?

R-58: At that time? No, so I changed to political science. I changed because I thought: no no, I can't do this. I will never use mathematics in my entire life. So that was one part. He believed in me. But it is also part that the head of family said: you should go to university. You need to educate yourself. You have all the possibilities in the world to do something good with your life, to go to university.

I-59: But not specifically STEM?

R-59: No. I could choose myself. So I started with theology. Because I thought I would be teaching religion and Swedish language. That was my goal. Then I went: no, this is not for me. So I did several other things but then I worked for a while and realised: I need to go on, I need to go to study. And then I thought: okay, perhaps my teacher was right in that in high school. So I opened the books and I took an evening course in mathematics and it went well because I opened the books. And then I went: okay, perhaps I should do this pre-year and so I did. So it's a combination of things. I had lots of female friends that have done it, I had lots of male friends that had done engineering and I had family that believed that I should go to university. I had teachers that believed that I could do it. So again, it's a mix of things and you need to have an entire society included when you look into these things. They are bigger. You need to look at the big picture before. So it's not really: oh, if we have one course, then everything will be solved and we will have more women in STEM. That's not so easy. But that's my opinion.

I-60: I agree with it as well. I already found out that a lot of cultural factors have to do with it as well, and not just these kind of programmes, that's not the only solution to it.

R-60: If that's it? Because I have another meeting starting at 10. We can call back, I will be out of office next week. I will be for a project meeting in Italy, so you can reach my email.

I-61: Okay, thank you. I think I have everything. I just wanted to ask- I need this consent form to be signed for this interview. Can I send it to you? It needs to be signed by hand so if you could scan it and send it back to me, that would be really nice.

R-61: Okay, perfect. Again, I will be away next week for work so I won't be in my office. It will be the week after that I can sign it.

I-62: That's fine. I still have a couple of weeks for that, so.

R-62: Okay, and I will try to find the figures I promised to give you.

I-63: Thank you again. It was really helpful.

R-63: Okay, no problem. Have a nice weekend. Bye Bye.

I-64: You too. Bye Bye.

Student Ethics Form

ES4 Guide for Final Project and Dissertation

2015-
2016

Appendix 6.3 – Student Ethics Form

European Studies
Student Ethics Form

Your name: Donya van Heezik
 Supervisor: Mr. Lord

Instructions/checklist

Before completing this form you should read the APA Ethics Code (<http://www.apa.org/ethics/code/index.aspx>). If you are planning research with human subjects you should also look at the sample consent form available in the Final Project and Dissertation Guide.

- ☒ Read section 3 that your supervisor will have to sign. Make sure that you cover all these issues in section 1.
- ☒ Complete sections 1 and, if you are using human subjects, section 2, of this form, and sign it.
- ☒ Ask your project supervisor to read these sections (and the draft consent form if you have one) and sign the form.
- ☒ Append this signed form as an appendix to your dissertation.

Section 1. Project Outline (to be completed by student)

(i) Title of Project:

(ii) Aims of project:

- The hidden gender gap in Swedish and Dutch higher education
 to find out how the Netherlands could implement measures which counter gender inequality in HE
- Will you involve other people in your project – e.g. via formal or informal interviews, group discussions, questionnaires, internet surveys etc. (Note: if you are using data that has already been collected by another researcher – e.g. recordings or transcripts of conversations given to you by your supervisor, you should answer 'NO' to this question.)

YES/ NO

If no: you should now sign the statement below and return the form to your supervisor. You have completed this form.

This project is not designed to include research with human subjects. I understand that I do not have ethical clearance to interview people (formally or informally) about the topic of my research, to carry out internet research (e.g. on chat rooms or discussion boards) or in any other way to use people as subjects in my research.

Student's signature _____ date _____

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2016

If yes: you should complete the rest of this form.

Section 2 Complete this section only if you answered YES to question (iii) above.

(i) What will the participants have to do? (v. brief outline of procedure):

They will answer open questions on the topic of my dissertation, their insights in this matter are relevant.

(ii) What sort of people will the participants be and how will they be recruited?

They are expertised in gender issues and in higher education and will be recruited via universities/hogescholen and feminist institutes/organisations

(iii) What sort stimuli or materials will your participants be exposed to, tick the appropriate boxes and then state what they are in the space below?

Questionnaires[]; Pictures[X]; Sounds [X]; Words[]; Other[].

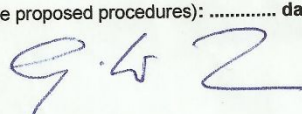
The interviews will be conducted via skype or face-to-face, or via email. The

(iv) Consent: Informed consent must be obtained for all participants before they take part in your project. Either verbally or by means of an informed consent form you should state what participants will be doing, drawing attention to anything they could conceivably object to subsequently. You should also state how they can withdraw from the study at any time and the measures you are taking to ensure the confidentiality of data. A standard informed consent form is available in the Dissertation Manual.

(vi) What procedures will you follow in order to guarantee the confidentiality of participants' data? Personal data (name, addresses etc.) should not be stored in such a way that they can be associated with the participant's data.

The participants will be asked for their consent before I include their name and position in my dissertation. All other personal data will not be provided (such as addresses).

Student's signature:  date: 12-1-2016

Supervisor's signature (if satisfied with the proposed procedures):  date: 13-01-2016

Informed Consent Form: Jansen

Informed Consent Form

1. Project Title

The 'hidden' gender gap in Swedish and Dutch higher education

Research question: How did Sweden manage to have consistently kept the smallest gender gap concerning gender stereotypes towards students in higher education compared to the Netherlands?

2. Project Description (1 paragraph)

The aim of this research is to find out in what way the gender gap could become smaller in higher education in the Netherlands. In the Netherlands, the female participation in higher education in the STEM field is very low compared to Sweden. In this report, the factors which led to these differences between the Netherlands and Sweden will be researched. Sweden is considered as a role model for the Netherlands concerning their policy on gender equality. For this reason, it is important to find out what the Netherlands can learn from Sweden in this matter.

If you agree to take part in this study please read the following statement and sign this form.

I am 16 years of age or older.

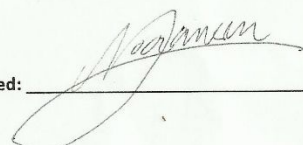
I can confirm that I have read and understood the description and aims of this research. The researcher has answered all the questions that I had to my satisfaction.

I agree to the audio recording of my interview with the researcher.

I understand that the researcher offers me the following guarantees:

- All information will be treated in the strictest confidence. My name will not be used in the study unless I give permission for it.
- Recordings will be accessible only by the researcher. Unless otherwise agreed, anonymity will be ensured at all times. Pseudonyms will be used in the transcriptions.
- I can ask for the recording to be stopped at any time and anything to be deleted from it.

I consent to take part in the research on the basis of the guarantees outlined above.

Signed:  Date: 11-2-2016

Informed Consent Form: De Jong

Informed Consent Form

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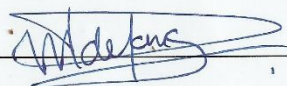
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- All information will be treated in the strictest confidence. My name will not be used in the study unless I give permission for it.
- Recordings will be accessible only by the researcher. Unless otherwise agreed, anonymity will be ensured at all times. Pseudonyms will be used in the transcriptions.
- I can ask for the recording to be stopped at any time and anything to be deleted from it.

I consent to take part in the research on the basis of the guarantees outlined above.

Signed: _____



Date: 15-01-2016

Informed Consent Form: Sandström

Informed Consent Form

1. Project Title

The 'hidden' gender gap in Swedish and Dutch higher education

Research question: How did Sweden manage to have consistently kept the smallest gender gap concerning gender stereotypes towards students in higher education compared to the Netherlands?

2. Project Description (1 paragraph)

The aim of this research is to find out in what way the gender gap could become smaller in higher education in the Netherlands. In the Netherlands, the female participation in higher education in the STEM field is very low compared to Sweden. In this report, the factors which led to these differences between the Netherlands and Sweden will be researched. Sweden is considered as a role model for the Netherlands concerning their policy on gender equality. For this reason, it is important to find out what the Netherlands can learn from Sweden in this matter.

If you agree to take part in this study please read the following statement and sign this form.

I am 16 years of age or older.

I can confirm that I have read and understood the description and aims of this research. The researcher has answered all the questions that I had to my satisfaction.

I agree to the audio recording of my interview with the researcher.

I understand that the researcher offers me the following guarantees:

- All information will be treated in the strictest confidence. My name will not be used in the study unless I give permission for it.
- Recordings will be accessible only by the researcher. Unless otherwise agreed, anonymity will be ensured at all times. Pseudonyms will be used in the transcriptions.
- I can ask for the recording to be stopped at any time and anything to be deleted from it.

I consent to take part in the research on the basis of the guarantees outlined above.

Signed: Kristina Sandström Date: 160216

KRISTINA SANDSTRÖM
UNIVERSITY WEST, SWEDEN