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2017

document version

Publisher's PDF, also known as Version of record

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citation for published version (APA)

Yazilitas, D. (2017). *Choice or Consequence? Explaining Differences in Female Participation in Mathematics, Science and Technology in the Netherlands and Sweden*. [PhD-Thesis - Research and graduation internal, Vrije Universiteit Amsterdam].

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CHAPTER 6

Summary and conclusion

6.1. Summary

The dissertation started from the observation that, while female participation in higher education has risen sharply in recent decades, it is an international phenomenon that female participation in MST fields is lagging behind. However, when we look at the share of female students across the EU and the OECD, we find large differences between countries, even among countries with similar levels of gender equality and socioeconomic development, such as the Netherlands and Sweden.

These sometimes remarkable differences are not explained by the existing research literature on gender specific choice patterns in MST, in which we can distinguish three types of explanatory frameworks: micro-level explanations; macro-level explanations and institutional level explanations. Micro-level explanations focus primarily on psychological constructs, that is, variables at the level of the individual students. Macro-level explanations focus primarily on socioeconomic conditions and cultural understandings of gender roles. Institutional explanations focus on design characteristics of (national) education systems.

While it is obvious that each of the three analytic frameworks helps to understand a piece of the puzzle of gendered study choice, they separately fall short in explaining the large differences in gendered study choice patterns across countries. This is then essentially about how these pieces interact. To explain large cross-country differences we require a deeper understanding of the interactions between individual students' choice processes towards MST and factors at play at the macro- and institutional level.

6.1.1 *The central research question*

To understand how different explanatory frameworks work together in explaining cross-country differences in gendered study choice patterns in MST, the primary focus of this dissertation has been on answering the following research question: In what way and to what extent do interactions between micro-, macro- and institutional level factors explain differences in female high school students' study choices towards MST fields between the Netherlands and Sweden?

From this three sub-questions have been derived:

- 1) Which types of explanations are currently given for gendered choice patterns in MST and what are their implications for designing further research in this field?
- 2) In what way do individual male and female high school students in the Netherlands and Sweden explain their own choices in favour of natural science tracks and how does this differ between the Netherlands and Sweden?
- 3) To what extent do male and female high school students in the Netherlands and Sweden differ in the way they evaluate and weigh different aspects of MST-studies when considering a study in these fields?

I will answer these questions in the next section, based on the findings of the four studies presented in this dissertation. This is followed by presenting my conclusions and providing a short discussion on the limitations and the implications of the findings presented in this dissertation for future research.

6.1.2 The research design

To better understand and explain cross-country differences in female participation in MST, this dissertation reports on an extensive literature study on gendered study choice patterns in MST, followed by case studies in which individual high school students' choice processes towards natural science tracks and MST fields are explored in two countries: the Netherlands and Sweden. These two countries are very similar in terms of socioeconomic development and gender equality. Yet, there is a striking difference in female participation in MST fields. In Sweden this participation is two-and-a-half times higher than in the Netherlands. The choice of countries also takes advantage of substantial migration from non-Western countries to the Netherlands and Sweden (for a definition of this category in the two countries, see chapter 3 and 4). As explained in the introduction, students with a migrant background from these countries are currently making study choices in the Dutch and

Swedish education system, which makes it possible to make both inter-institutional as well as intercultural comparisons.

Assuming that insight in individual choice processes may reveal the reasons behind different choice patterns towards MST fields between Sweden and the Netherlands, I explored individual students' choice processes towards natural science tracks and MST study fields from both sexes, with different cultural backgrounds, in the Dutch and Swedish education systems, using a mixed methods approach.

6.1.3 Results of the literature study and two case studies¹

6.1.3.1 Review of the literature

In order to understand the general problem of gender imbalance in MST, I first conducted an extensive literature study in chapter 2.

As explained earlier, the research literature on gender imbalances in MST fields provides various explanatory frameworks, at various levels of aggregation (for an overview, see Yazililitas et al., 2013).

Explanations at the micro-level refer to individual student characteristics. An example is the finding that girls' mathematics self-efficacy beliefs tend to be lower than boys'. This would explain why girls opt for MST less often (Bussey & Bandura 1999; Lent, Brown & Hackett, 1994).

Explanations at the institutional level relate gender differences in study choice to characteristics of the education system. For example, countries with highly differentiated education systems are found to produce more gender inequality than countries with less differentiated systems (Charles, 2011; Van Elk, Van der Steeg & Webbink 2011; Wößmann, 2009).

Explanations at the macro-level focus on societal factors, such as dominant cultural values and gender roles, which can explain different patterns in different societies. Here, Schreiner and Sjøberg (2005; Schreiner, 2006; Sjøberg and Schreiner, 2005) have applied Inglehart's modernization theory (1997; Inglehart & Norris, 2003; Inglehart & Welzel, 2005), to provide an insightful explanation for the paradoxical gender imbalances

in study choice in Western Countries.² Schreiner and Sjøberg argue that economic development and prosperity, in these countries, has led to an increased dominance of postmaterialist values, and that as a result study choices are more based on intrinsic motivation and on the connection of study fields to students' core identities. Following this assumption, Schreiner and Sjøberg further argue that men and women in late modern societies, when offered a choice between different alternatives in higher education, will tend to choose study fields which are more in line with their gender roles, which leads to a division in male and female fields of study. On the contrary, women in less developed societies appear less concerned with these identity issues and more often choose to study in non-traditional fields, including MST, because their choices are more driven by modernist values, like a concern for material security. Although the same explanatory mechanism applies to men and their educational choices, Sjøberg and Schreiner argue that the difference in academic choices in different societies is nonetheless smaller, because men's core identities and gender roles are much less contested in other academic fields than women's in MST. Research by Charles and Bradley (2009) on sex segregation by field of study in higher education across 44 societies, including both developed, developing and transitional countries, shows that sex typing of MST is indeed stronger in more economically developed contexts. Consequently, I therefore expected that not only male and female students make different choices, but also that students whose families originate from economically less developed societies, that is, students with an immigrant background from these societies, will choose differently from native students in more developed country contexts.

As I concluded in chapter 2, it is obvious, that each of these analytic frameworks indeed helps to understand a piece of the puzzle of gendered study choice. However, it is also clear that focusing on each of these pieces separately may obfuscate the puzzle as a whole, which is essentially about how these pieces interlock in practice. Given the scientific evidence available, it is clear that individual, cultural and institutional factors all play a role in explaining gendered patterns of choice in MST

fields. However, still little is known about the way these factors interact when students make their actual choices.

In order to get more insight on how these factors work together, I have examined Dutch and Swedish high school students' study choice processes towards natural science tracks in chapter 3 and 4. Particularly, I set out to explore this difference in female participation in MST between Sweden and the Netherlands, taking into account the various micro-, macro and institutional level explanations for gendered patterns in MST. Furthermore, following Schreiner and Sjøberg (2004; Schreiner, 2006; Sjøberg and Schreiner, 2005), I assumed that students with a migrant background might differ in their cultural values and gender role expectations. I therefore decided to also study the possible effect of having a non-Western migrant background on gendered study choices.

6.1.3.2 A qualitative assessment of individual students' choice processes

The study of the differences in female enrolment in the Netherlands and Sweden started with separate case studies in both countries in which we explored the educational systems and conducted semi-structured interviews with the students about their study choices.

A major insight gained from these qualitative studies was that male and female students' choice processes regarding natural science tracks and interest in MST study fields in the two countries were very similar, both in terms of ideal types and gender differences.

After analysis of the interviews in both countries we were able to distinguish three ideal types of students. In the Netherlands these were labelled: the postmodern perfectionist, the pragmatic hedonist and the material maximalist. In Sweden they were labelled: the postmaterial idealist, the postmaterial maximalist and the material maximalist (see chapter 3 and 4 for a detailed description of each of these types). Each of these ideal types represented the choice processes of a particular group. In both countries, female students were clearly overrepresented in the first type, i.e. the postmodern perfectionist and

the postmodern idealist, whereas within the second type, the gender balance was slightly in favour of male students. A third type consisted of a more mixed group. In relation to students' background, students' with a native background were overrepresented in the first and second type, whereas students with a non-Western migrant background were overrepresented in the third type.

In accordance with the genderedness of these ideal types in both countries, I found that the majority of postmodern perfectionist and postmodern idealist are not very motivated to choose a MST field in higher education. This even applied to those students who opted for natural science tracks that lead MST fields. In practice, even these students showed a strong preference in fields and careers related to medicine and other health related fields, or opted for natural science tracks in order to keep their options open. Thus, female student's choices in favour of the natural science tracks in both countries appeared to be predominantly extrinsically motivated. This applied also to the third group. However, where postmodern perfectionists and postmodern idealists put a lot of effort in getting high scores and preferred future fields of study in which could help others or realise themselves to their full potential, the material maximalist and modern maximalist typically choose natural science tracks in order to secure a high status and secure job. The majority of the pragmatic hedonist and postmaterial maximalist on the other hand appeared to be more intrinsically motivated to choose natural science tracks MST fields. These students also emphasized the importance of achieving success, both financial and personal, more than other students and appeared to be less concerned with obtaining high grades. They also reported to experience less pressure from significant others, such as parents and teachers, to make a certain study choice.

Furthermore, when talking about their future study choices, students in both countries focussed on a very similar set of factors, namely intrinsic motivation, future job prospects, self-realisation value, self-efficacy beliefs, expectations with regard to hard work and perceived pressure from significant others (see chapter 5 for a description of each of these factors).

Also, the differences in study choice preferences between boys and girls were found not only to result from differences in these evaluations of MST fields on these individual factors, but also, and perhaps more importantly from differences in the implicit weight they assigned to these factors. For example, for girls, as compared to boys, MST fields not only seemed to have a lesser connection with ideas of self-realisation, it also seemed that this aspect of self-realisation was more important to girls.

Moreover, in discussing these individual factors, I found that these evaluations in both countries were to some extent shaped by similar institutional conditions. For both Dutch and Swedish girls, for instance, the self-realisation value of the natural science track was for a large part shaped by the fact that this track gave access to a much wider set of university study fields in health and medicine.

Importantly, these gender differences were found to be similar for students with a native Western background and for students with a non-Western migrant background. This means that the expectation that female students with a native Western background would have less positive attitudes towards MST fields, not only compared to native Western male students, but also compared to both male and female students with a non-Western migrant background, received limited support in the qualitative studies.

In line with Schreiner and Sjøberg's educational modernization theory, I had expected and indeed found that students with a non-Western background were driven to a larger extent by material values. However, compared to the effect of gender, this background factor appeared to have only a very a limited effect, as especially in the Netherlands, students with a native Dutch background appeared to be guided by material value orientations as well. This latter fact may well have been related to the period in which the data were collected, almost 4 years after the financial crisis started. This seems to run somewhat contrary Schreiner and Sjøberg's theory as well as the underlying assumption by Inglehart's theory on postmodernity that the shift in cultural values from materialist to postmodern is a linear process. In other words, the recent financial crisis seems

to have caused some re-shift towards more materialist values. Having said this, the final conclusion from the two case studies was that the differences in gendered study choice between the Netherlands and Sweden had become even more paradoxical. This left us with a puzzling question: Why do significantly more female students in Sweden opt for MST studies in higher education if Dutch and Swedish girls in high school think so alike about natural science tracks?

6.1.3.3 A quantitative assessment of students' intentions to choose MST

To understand why relatively more female students in Sweden still opt for MST, in spite of similar levels of gender equality, socioeconomic development and similar perceptions of natural science tracks in high school, I decided to conduct an additional quantitative study. This study focused on explaining the differences in MST-intention between Swedish boys, Swedish girls, Dutch boys, and Dutch girls.

Based on the literature study and the results from the two case studies, I expected students' intentions to choose MST fields to be explained by the six factors identified earlier, i.e. intrinsic motivation, job-prospects, self-realisation, self-efficacy, hard work and perceived pressure.

I furthermore expected to find three effects. First of all, I expected girls to have more negative perceptions of the six factors than boys. Secondly, I expected gender differences in students' perceptions of MST fields to vary by country, i.e. that Dutch girls have more negative perceptions on the six factors than Swedish girls. And thirdly, I expected that the extent to which each of the six factors explained students' MST-intention would differ for the different country-gender combinations.

These expectations were confirmed to some extent.

With regard to the first expectation, I found that girls in both countries had lower MST self-efficacy beliefs than boys and expected MST fields to require more hard work. With regard to the second expectation, I found that Dutch girls significantly differ from Swedish girls in that they have a lesser intrinsic motivation to choose MST and also expect MST fields to require less hard work.

With regard to the third expectation, I found that, although the variance explained in MST-intention by the six factors is limited, girls and boys, in the Netherlands and Sweden, attach quite different weights to the six factors, with Dutch girls' MST-intentions being most clearly affected by intrinsic motivation, self-realisation, hard work and self-efficacy beliefs and Dutch boys' MST-intentions being affected by expectations of hard work and perceived pressure. In the case of Sweden, girls' MST-intentions were most clearly affected by intrinsic motivation, whilst not a single factor clearly affected Swedish boys' MST-intentions.

How can we understand the results of the quantitative study to explain gender differences in the participation in MST fields in higher education between Sweden and the Netherlands?

It appears that direct gender effects play a role in explaining differences in female participation in MST. However, the interaction between country and gender suggests that it is particularly Dutch girls who have very low perceptions of MST, rather than girls in general.

In chapter 5, several explanations are suggested for this unexpected finding.

A first and obvious explanation relates to possible differences in how MST subjects are taught and – closely linked – what is being taught, i.e. differences in pedagogy and curricula, between the two research countries, which link the institutional to the national contexts.

Secondly, at a societal level, country specific features of the higher education system and the labour market, may explain why so few Dutch girls opt for MST, compared to their peers in Sweden. The Dutch labour market, with its strong focus on services, might possibly offer different career opportunities than the Swedish.

Thirdly, differences might also be explained by differences in the way care and labour is organized in the two research countries, which also links back to the second explanation. In particular, in light of the expectation of working part-time, it is likely that Swedish and Dutch girls make different assessments about future study and career choices. This is further supported

by our finding that Dutch girls attach more weight to self-realisation than Swedish girls.

Altogether, the conclusion is justified that there is support for the underlying mechanisms of the theoretical model that was tested, although uncertainty and ambiguity still exist. Moreover, differences in students' perceptions and the subsequent weight assigned to them between Swedish and Dutch girls are smaller than initially expected and as such insufficient to explain differences in female participation in MST fields in higher education.

6.2 Conclusions

In what way and to what extent do interactions between micro-, macro- and institutional level factors explain differences in female high school students' study choices towards MST fields between the Netherlands and Sweden? With regard to interactions between micro-, macro-, and institutional level factors, it is possible to conclude that interactions play an important role in explaining gender differences in MST participation.

The qualitative case studies, for example, clearly show that for both Dutch and Swedish girls, the self-realisation value of the natural science track is clearly shaped by the fact that this track gives access to a much wider set of university study fields in health and medicine. With respect to students' choice for natural science tracks in the two countries this suggests an interaction between gender, self-realisation and the institutional context.

In relation to the expectation that the extent to which each of the six factors affects MST intention is dependent on not only the students' gender but also on their country background, the results from the quantitative studies indicate that Swedish boys, Swedish girls, Dutch boys and Dutch girls attach quite different weights to the six factors. Importantly, this implies an interaction between students' country background and gender.

With regard to the question of really explaining the differences in female participation in MST, in the Netherlands and Sweden, I am not yet satisfied. As gender differences in students' choice processes towards natural science tracks follow similar patterns in the two countries, I still cannot fully explain the huge cross-country differences in female participation. The

differences between Swedish and Dutch female students' perceptions of MST fields seem too small.

6.2.1 Limitations and recommendations for further research

The findings presented in this dissertation are also limited to some extent. The main limitation, as explained in chapters 3, 4 and 5 concerns the non-random selection of schools and pupils. For practical reasons, the data collection was geographically limited to two particular cities, and to those schools in these cities that were willing to participate in this study. Consequently, generalizability of the empirical findings is limited. The value of this dissertation, however, lies in developing this approach and in my effort to explore the theoretical mechanisms at play. My research also raised several new questions that deserve to be investigated.

It appears that the level of socioeconomic development, although crucial, is only the starting point to explain gender differences from a comparative perspective. To take this idea further, a deeper, more detailed analysis seems to be required, with special attention to precise labour market structures, care arrangements and family policies.

In order to gain more thorough knowledge of the underlying mechanisms of the gender imbalance in MST and other study fields, more research is needed. Research that preferably uses random samples and includes students from more diversified national, institutional and socioeconomic contexts.

Following Schreiner and Sjøberg, I assumed that students with a non-Western migrant background would differ in cultural values and gender role expectations, as compared to native Western students. It is for this reason that I paid attention to possible differences in study choice behaviour between students of these different ethnic backgrounds. However, although I did find some differences in students' value orientations in relation to the choice for natural science tracks and interest in MST, students with a native and non-Western migrant background did not distinctly differ in their choice processes towards natural science tracks and interest in MST fields. It is possible that the

relationship between gender and ethnicity is more complicated, and also dependent on other factors besides parents' country of birth, including parents' socioeconomic status, number of years in the host country and reasons for migration. It is recommendable that future research further explores these differences in relation to cross-country variations in female participation in MST in order to gain a more thorough understanding of the role of ethnicity.

Also, more different national contexts could be included in the comparison to improve our understanding of the variety in female participation in MST across countries, including countries that are less comparable in terms of gender equality and socio-economic development. Initially, I wanted to add Iran or Turkey as a third research country in the comparison, to include a country with more traditional gender roles, yet where female participation is higher than in a lot of developed, Western countries. However, since this appeared to be a too ambitious plan given time constraints, I replaced the three country comparison by a two country comparison, and choose to compare the choice patterns of students with a native Western background with those of the more broad category of students with a non-Western migrant background. The two research countries were consequently primarily chosen based on the large difference in female participation, high level of gender equality and the availability of a diversified migrant population in Sweden and the Netherlands. While I still believe this was the right decision to make it would also be interesting to include in the comparison countries that differ in the way education is institutionally organized.

I focused on students' choice processes and choices in upper secondary level in two countries with similar types of choices that students are required to make in order to enter MST, yet it is also advisable to extend research efforts to include more diversified institutional contexts and include more choice and/or selection moments in students' school careers, including in lower secondary education and in higher education.

Finally, I recommend studies that are similar to mine, but that focus on fields with an opposed gender imbalance, such as health and education. Studying such fields would make it

possible to assess whether the gender differences found in this dissertation are context specific to MST fields or have a more general basis.

Endnotes

1. This paragraph is partially based on chapter 5.
2. Schreiner and Sjøberg, use the terms 'Western', 'developed', 'modern', 'modernized' and 'late-modern' as synonyms in reference to cultural, economic and political development in Western societies.

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