Investigation of the STEM gender-gap

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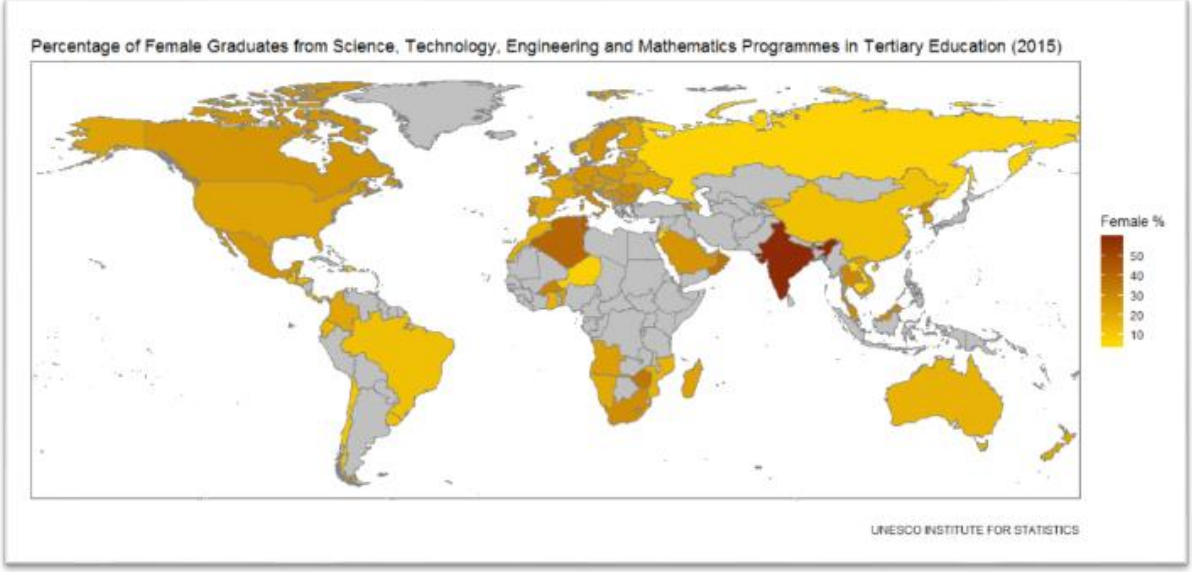
Introduction

Women have a low participation rate in STEM (Science, technology, engineering, and math), and addressing this issue has gained increasing support all over the world, by policy makers and the media alike.

It has long been presumed, that if gender equality increased in a country, more and more women would enter the STEM field, but despite substantial efforts toward understanding and changing this pattern, the sex difference has remained present for decades, and even widened in some countries.



There is a wide range of theories and possible explanations behind the cause of the gender gap, such as gender stereotyped socialization occurring inside family context and in schools, and throughout this project I tried to help an educational research company in their efforts to uncover an aspect of this issue, approaching from the direction of analysing high school students' performance on the PISA test.

PISA

PISA, the Programme for International Student Assessment, is the world's largest educational survey designed by education experts all around the world. PISA is designed to assess the capabilities of students nearing the end of their studies (ages 15), with regards to how well they can apply what they have learnt in school, to real life situations. In 2015, science literacy was studied in depth, by including additional questions about student attitudes and socioeconomic factors.

Therefore, it was a great data source going into depth about students scientific literacy, with a wide range of variety with respect to what aspects of students' lives it measured, not to mention the immense amount of data. Unfortunately, somewhat to my disadvantage, PISA has a very peculiar and specific framework and a correspondingly complicated analysis methodology. What this meant with respect to my analysis is that I had to do immense amount of research to gain domain knowledge in this specific field of educational surveys.

The Evolution of the Analysis

Originally, my analysis started off on quite a different track. The original project was also an approach to this gender gap, but instead of looking at girls and boys reading comprehension differences, I attempted to investigate gender stereotyped socialization occurring inside family context and in schools, influencing children's motivation when it comes to achievement in settings such as those structured around STEM related topics.

The objective of the analysis changed quite often, as the result were never what we expected them to be. Throughout the initial discovery phase of the analysis I found that girls not only have similar proficiencies in scientific literacy, but they are also as equally interested in pursuing science related careers at the age of 15 as boys are. This suggests that somewhere after the age of 15, along the way of becoming a STEM graduate, these students and specifically girls, decide to pursue different careers.

STEM Gender Equailty Paradox

When I presented these first initial results to my client is when the analysis first took a turn into the direction of the so-called *STEM gender equality paradox (*Stoet& Geary, 2018), which is about the counterintuitive pattern recently discovered, where the more gender equal a country is, the lower the percentage of female graduates in STEM.

This was the part in my project where we were finally able to formulate a hypothesis that I could examine. We hypothesized that boys' disadvantage in reading comprehension and therefore their shortcomings in social sciences steers them towards disciplines of their relative strengths (sciences and mathematic). This in turn does not allow that many women to enter the STEM field, further reinforcing the social and cultural stereotypes about women's lack of abilities to do well in these fields (discouraging girls even more from wanting to become scientists and therefore feeding a never-ending cycle reinforcing the gender gap).

Challenges and Solutions

As mentioned before, since PISA has a very specific analysis methodology, it was really difficult to use most of the methods that I would have used otherwise to prove our hypothesis. It is also important to mention, that PISA is usually analyzed in SPSS, and there are a lot of publicly available resources to help analysts, but those are mostly available for SPSS. Although I have some practice using SPSS from my undergraduate studies, I wanted to take this opportunity to improve my R coding skill, and therefore I stuck to completing my whole analysis in R. Considering the immense amount of data, computational time and processing power proved to be big disadvantages as well, in keeping a good workflow.

Having no background in educational research was also a disadvantage, as the domain knowledge needed to compare and contrast different countries' and cultures' performance requires knowledge that is simply not possible to acquire in the time of just a few months. Luckily, my client that I worked with was not only extremely helpful and informative when it came to my lack of background knowledge, but she is also quite brilliant in the sense that whatever kind of new result I showed her she always had a couple hypotheses to explain them.

Even though this project was really challenging and took a lot out of me, I also enjoyed it and have learnt a lot. Being a woman in a STEM field I found it exciting and fascinating to discover this issue, and I have learnt a lot along the way, both about educational research as well as working through a project by oneself.

If I had the chance to work on this project longer, I would definitely bring in the results of previous years of PISA. As a matter of fact, I did analyze data all the way from the 2006 results, but when it came to comparing, the constraints of the PISA framework made it too difficult to complete within the scopes of this capstone project.

Final Remarks

Overall, this was a great learning experience and I am very fortunate to have been a part of it. It helped me get comfortable with talking to the client, made me practice planning the steps of my analysis and gave me a comprehensive understanding of how to apply all that I've learnt in this past year of going to CEU.