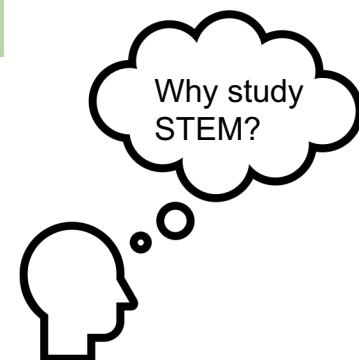


Gender (In)Equality in German Engineering

Introduction

After the United States and China, Germany is the world's largest producer of research in science, technology, engineering, and mathematics (STEM) fields. This development has been fostered by the institutionalization of strong research universities and extra-university research institutes (Dusdal et al., 2020). Germany spends more per capita on STEM research and development than either the United Kingdom or France, which are two other major European leaders in STEM. Still, the persistent underrepresentation of women in STEM (Nimmegern, 2016) has a massive negative impact on the labor force and economic growth. As a global leader in STEM research, the German government has focused on improving women's attainment in engineering fields through the implementation of various national initiatives to foster equal opportunity and to attract and retain women in STEM fields (Best et al., 2013). Although Germany is at the forefront of producing talented graduates in STEM, in 2015 fewer than one out of three students were STEM graduates (OECD, 2017). Gender remains one of the most crucial factors in study choice and decision for engineering and natural sciences in Germany (Heine et al., 2006).

Aim of the study: We determine the extent to which German women consider studying a STEM field, even if they do not choose to do so. We then seek to examine the reasons (interests, perceptions, and choices) why women may choose or opt-out of studying engineering, we discuss implications for recruiting women into engineering, and finally, we highlight promising policies and practices to attract women into STEM.



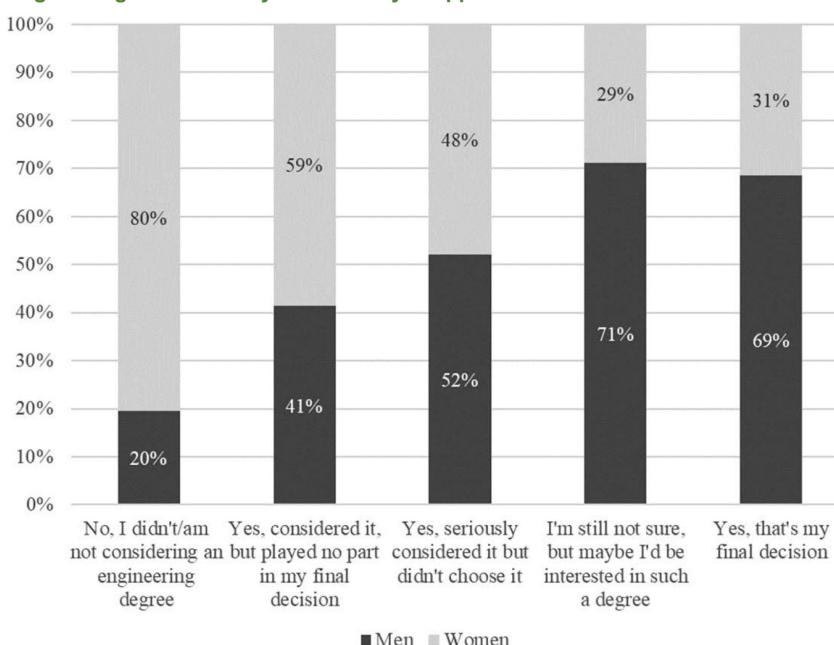
Data and methods

Panel of Secondary School Leavers of the German Centre for Higher Education Research and Science Studies (DZHW), Germany.

- Three waves of data from participants who have the requisite qualifications to attend a German research university or a university of applied sciences
- We analyzed data from the 2nd wave (data collection 2008–2009); examination of women in engineering as a subset of STEM
- We analyzed unweighted data and examined gender differences for two survey items:

“Have you considered starting a course in the engineering sciences at a university or university of applied sciences?” → if not
“Why did you decide not to start an engineering sciences degree?”

Figure 1: Percentages of secondary school leavers who considered studying engineering at a university or university of applied sciences



Note: Authors' analysis of the 2nd wave of the DZHW Panel Study of Secondary School Leavers 2008.

Table 1: Reasons high school leavers decided not to start an engineering degree

	Women		Men	
	Yes	No	Yes	No
My interests lie in other fields	86%	14%	79%	21%
The way technology was taught at school had a negative effect on me	30%	70%	17%	83%
I cannot fulfill the prerequisites because of my subject specializations in school	26%	74%	28%	72%
I think an engineering degree would be too boring	16%	84%	15%	85%
Find the engineering profession quite attractive, but I'd possibly not be able to handle the degree	14%	86%	22%	78%
The courses in the technical fields which interest me are too far removed from real life	4%	96%	5%	95%
I'm interested in a degree/career in engineering but as a woman I don't think my chances are very high	4%	96%	-	-
An engineering degree would be too work-intensive for me	3%	97%	5%	95%
Because the career prospects are too insecure for me in the subject area I'm interested in	2%	98%	5%	95%

Note: Authors' analysis of the 2nd wave of the DZHW Panel Study of Secondary School Leavers 2008.

We ♥ Stats (WT 2019/20)

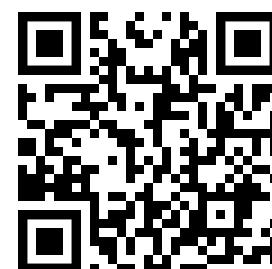
- 1.8m students were enrolled at unis (♀52%); 1m at unis of applied sciences (♀45%) (DESTATIS 2020a)
- 1m students were enrolled in science and engineering (♀31% total; ♀engineering 24%) (DESTATIS 2020b)
- Women who study subjects where they make up <35% of enrollments face a drop-out risk which is 1.5 times higher than men's and almost twice the women's in a subject where they are better represented (Meyer & Strauß, 2019: 451)
- When focusing on engineering and technology, the gender gap more than doubles compared to a traditional classification of STEM disciplines (Jacob et al., 2020)

Promising policies and practices

- 1) Girls' (and Boys') Day
- 2) ,Go MINT' – National Pact for Women in MINT careers
- 3) UniMento (U. Augsburg)

These three initiatives illustrate existing opportunities to address women's perceptions and choices about STEM fields—engineering in particular

You can find our paper here:



Conclusions

- 1) It remains difficult to disentangle the actual reasons (incl. structural and cultural aspects) for sustained gender differences in STEM empirically (Isphording & Qendrai, 2019) → *future research*: use of multiple data sources, methods, and longitudinal data to investigate why women are underrepresented in STEM as well as changes in occupational preferences (Haas & Hadjar, 2019; Hägglung & Leuze, 2020)
- 2) HE research needs to tackle 3 problems (Heublein, 2014): definition and measurement of drop-out; clarification of the individual, institutional, and social causes; dangers of above-average dropout of specific risk groups
- 3) We suggest that it is necessary to consider individual perceptions, motivations, and choices when examining gender disparities in STEM
- 4) This paper demonstrates that Germany has an opportunity to maintain and expand its considerable scientific STEM excellence by pursuing greater gender equality in STEM higher education