

WOMEN IN MATHEMATICS IN GERMANY

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The research panorama in Germany presents a male predominancy, as well as in several other European countries, but the share of female researchers is increasing over the last years. This positive trend has been indeed confirmed by the findings of a recent study conducted by Elsevier Analytical Services in 2015 [1]. This report shows that the proportion of female researchers who published in the period 2010–2014 with affiliations to German institutions has increased from the 28.2% of all gender-identified researchers in Germany to 30.9% in 2014 (see Figure 1). Moreover, in this time frame the number of female researchers in Germany has grown much more rapidly than the one of male researchers. Indeed, this latter has increased by 9.8% (2010: 111,605 and 2014: 122,593) while for females this increase has been of 25% (2010: 43,728 and 2014: 54,742).

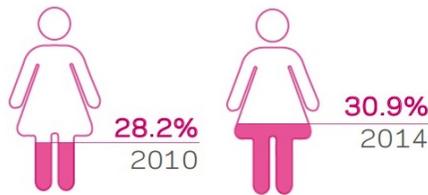


FIGURE 1. Proportion of female researchers in Germany in 2010 and in 2014

This general positive trend is similarly reflected across the states in Germany (NUTS1; see left of Figure 2). In fact, the distribution of female researchers per federal state is quite uniform all over Germany and the average share of women in academia in the period 2010–2014 is about 36.4% of the total number of researchers. The highest percentage of female researchers (40.2%) is reached in Schleswig–Holstein while the lowest (32.6%) in Thüringen. More variations have been instead observed at the government region level (NUTS2; see right of Figure 2): Dessau, Leipzig, Giessen, Schleswig-Holstein and Tübingen have the highest female ratios of over 40% in contrast to Stuttgart, Chemnitz, Schwaben and Niederbayern whose female ratios are below 25%.

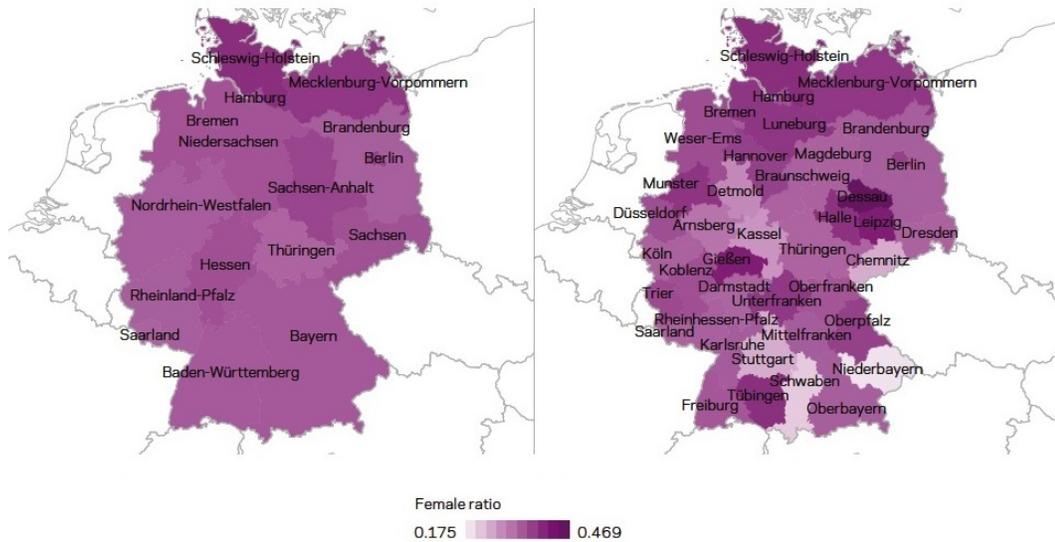


FIGURE 2. Share of female researchers per state/NUTS1 (left) and per government region/NUTS2 (right) in Germany in the period 2010–2014

A great variation in the share of female researchers has been also observed across the subject areas. The data in [1] show that female researchers in Germany tend to concentrate in Medical and Social Sciences, while the STEM disciplines (Science, Technology, Engineering and Mathematics) have the lowest shares of women. In particular, the proportion of female mathematicians has been the second lowest one over the period 2010-2014 (the lowest share of women is in Computer Science). However, the distribution of women in Mathematics reflects the general positive pattern in Germany (see Figure 3) suggesting a reduction in the gap between the number of female and male researchers also in this traditionally male-dominated field.

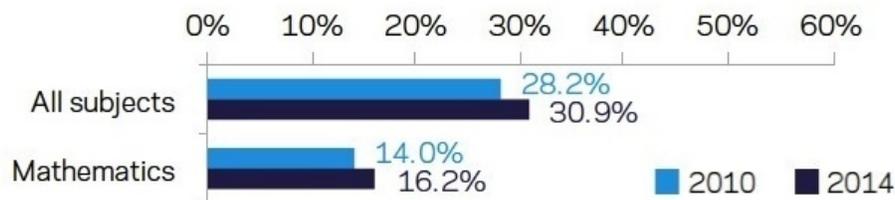


FIGURE 3. Share of female researchers out of all researchers who are affiliated to German institutions and published in mathematical journals in 2010 and in 2014 (compared to the general share of women in all subjects)

This good trend in the Mathematics departments at German universities is confirmed by the data collected by the German Federal Statistical Office (DESTATIS, [3]). According to DESTATIS, there has been an increase of almost 7% in the number of women employed full-time as academic staff in Mathematics from 2005 to 2014 (see Table 1) even if the female shares remains much lower than the male ones (see Figure 4).

	Total	Women	Female %
2005	4 091	676	16.5
2006	4 115	703	17
2007	4 249	788	18.5
2008	4 518	871	19.3
2009	4 710	921	19.5
2010	5 027	1012	20.1
2011	5 249	1111	21.2
2012	5 510	1186	21.5
2013	5 724	1275	22.2
2014	5 770	1342	23.2

TABLE 1. Full-time academic staff in Mathematics at German universities in 2005–2014

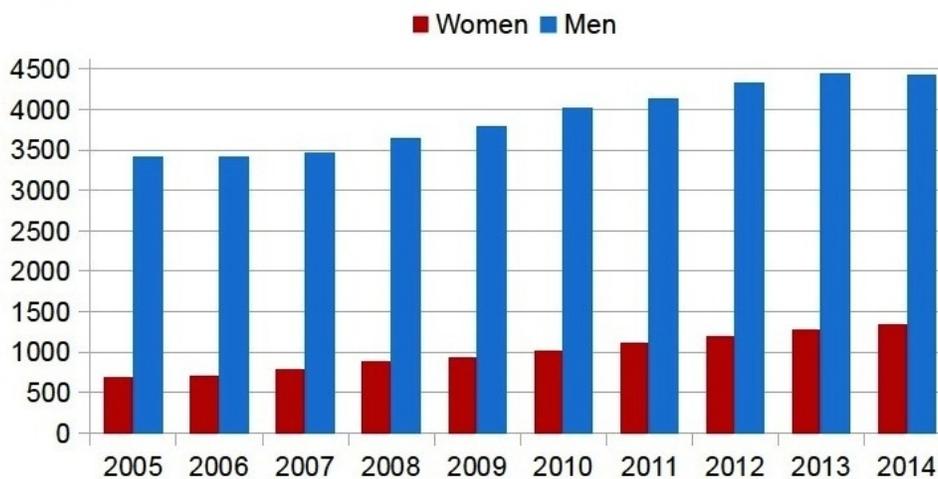


FIGURE 4. Gender distribution of the full-time academic staff in Mathematics at German universities in 2005–2014

A critical point in the academic career is surely the passage from a post-doctoral position to a professorship. Nowadays in several countries in Europe this is a very hard step because of the decreasing number of permanent positions in academia and this is the point when several young researchers give up an academic career in favor of other kind of jobs. Traditionally in the German academic system to apply for a tenured professorship one needs

to get a further academic title (higher than Ph.D), the so-called Habilitation. Therefore, the number of researchers who get the Habilitation is certainly an indicator of the will in the young research community of continuing an academic career. The number of researchers getting the Habilitation in Mathematics at German universities has been very oscillating in the period 2005–2014. However, in this same period, the number of women achieving the Habilitation in Mathematics has been constantly much lower than the one of men with an average share of about the 17% of the total number of researchers getting this title in Germany (see Table 2 and Figure 5).

	Total	Women	Female %
2005	62	11	17.7
2006	43	6	13.9
2007	44	6	13.6
2008	50	6	12
2009	48	4	8.3
2010	42	11	26.2
2011	43	5	11.6
2012	33	5	15.2
2013	31	7	22.6
2014	38	5	13.1

TABLE 2. Researchers getting the Habilitation in Mathematics in Germany in 2005–2014

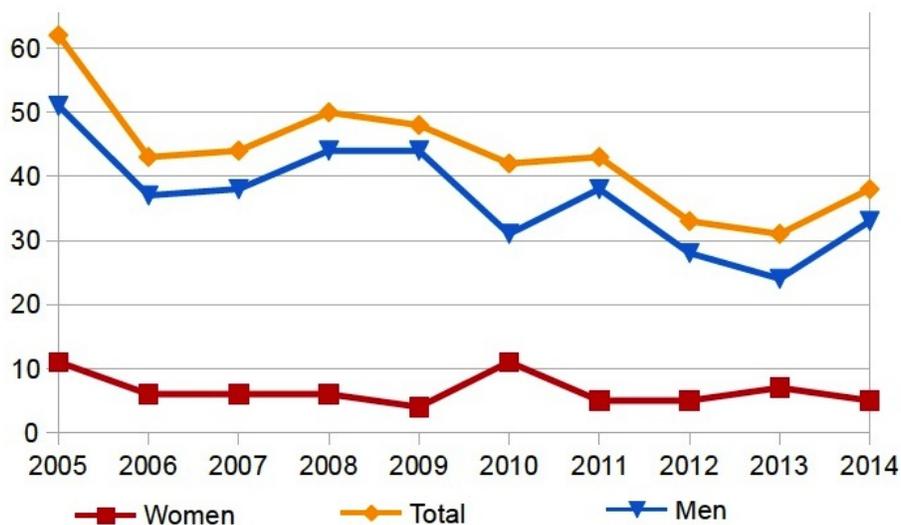


FIGURE 5. Gender distribution of the researchers getting the Habilitation in Mathematics in Germany in 2005–2014

Independently of the gender, the number of mathematicians getting the Habilitation at German universities is in general not so high (see Table 2).

This must be just the effect of the current insecure horizon offered by an academic career nowadays or it might also be due to the fact that since 2002 there exists an alternative path towards a tenured position as a professor in Germany, i.e. getting a junior professorship. This is a fixed-term professorship up to six years during which one receives periodical evaluations from his/her own university and, if positive, he/she is expected to apply for an associate or full professorships at other universities.

As for the proportion of women in Mathematics at different study/career stages, the most recent data collected by DESTATIS [3] report that the number of women decreases by advancing in their academic path (see Table 3). In contrast to a situation of almost perfect gender equality at the student level in 2014 (number of enrollments, bachelor and master degrees), the gender distribution became more and more unbalanced with the Ph.D. until reaching a male-dominated situation at the professor level (see Figure 6). However, this configuration at the higher stages is surely still influenced by the unbalanced gender distribution in Mathematics of the past, so we should not look at it with too much negativity. We should instead focus on the encouraging sign for the future given by the high share of female students.

	Total	Women	Female %
Students enrolled	33728	72391	46.6
Bachelors completed	2665	1020	38.2
Masters completed	1117	395	35.4
PhD completed	562	132	23.5
Fixed-term researchers (e.g. postdocs, fixed-term lecturer)	3697	905	24.5
Professors (tenured and non)	1247	185	14.8

TABLE 3. Proportion of women in Mathematics per study/career stage in 2014

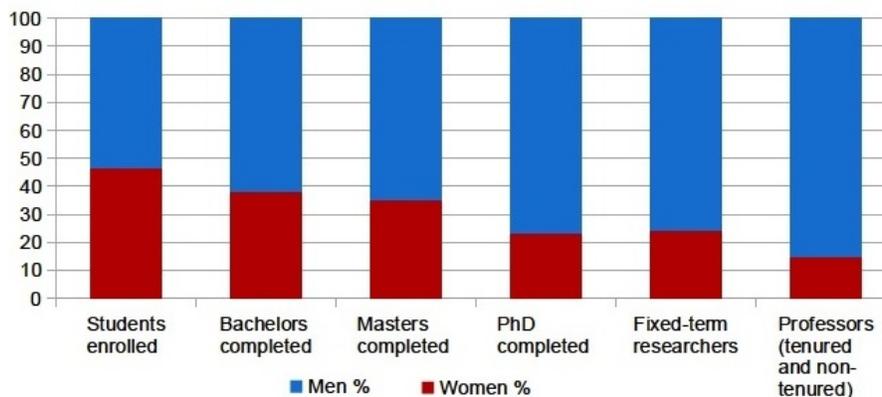


FIGURE 6. Gender distribution in Mathematics per study/career stage in 2014

The share of female professors is nowadays about the 15% of the total number of tenured and non-tenured professors in Mathematics affiliated to German universities. For a long time, the majority of Mathematics departments in Germany did not have a single woman professor, nowadays these departments form a minority. Indeed, only 9 Mathematics departments out of all 68 German universities do not have any female professor while almost the 30% of the Mathematics departments has at least 3 female professors (see Figure 7 taken from [2]). Clearly, in reading these data we should take into account the total number of professors in each of these departments of Mathematics, as in small universities a low number or an absence of female professors might be just a matter of probability rather than of gender biased hiring.



FIGURE 7. Map of female professors in Mathematics in Germany

There are several associations in Germany focused on supporting women in Mathematics at all stages of their careers with the aim of reducing the gender gap. First we should mention the organizations existing at a european level whose activities of course have a strong impact also in Germany. Among them the best known is surely the association *European Women in Mathematics (EWM)*. This was created in 1986, after the participation of many European mathematicians to a roundtable organized at the International Congress of Mathematics in Berkeley by the Association for Women in Mathematics (AWIM) based in the United States. The EWM currently counts more than 400 members and has coordinators in more than 33 european countries. Among the aims of this association are: encouraging women to study Mathematics, supporting women in their academic careers, giving prominence and visibility to female mathematicians. Moreover, the EWM sponsors meetings, lectures and initiatives to promote equal opportunities and to spread the awareness of the gender gap in Mathematics, such as the biennial EWM general meeting (for more information see [4]).

Acting in close relationship with EWM and with similar aims, there is the *European Mathematical Society's Women and Mathematics Committee* (see [5]). This committee, consisting of 8 members, was established in 1991 to address issues relating to the involvement and progression of women in Mathematics, and to support and promote the recognition of their achievements. It largely acts as a liaison body between the European Mathematical Society (EMS), the EWM and other similar organizations on these issues.

Finally, in 2008 the EWM and EMS Women and Mathematics Committee jointly set up the *EWM/EMS Scientific Committee* (see [6]). The main function of this committee is to advise EMS and EWM on scientific programmes and speakers for events aimed at emphasizing women's scientific contributions. For instance, this year the EWM/EMS Scientific Committee organized an event at the 7th European Congress of Mathematics in Berlin to celebrate female mathematicians of excellence in Europe.

At a national level, since the early days of EWM, there exists a *German Section of EWM* which currently counts more than 50 members. The German section of EWM organizes an annual national meeting and maintains a newsletter with information on job ads and other matters of interests for female mathematicians working in German universities.

The German Mathematical Society (DMV, see [7]) has *Diversity and Equal Opportunities* as one of its fields of activities and closely cooperates with the German section of EWM. Among the initiatives of DMV to support women there are the *Emmy Noether Lectures* initiated in 2008 by the Diversity and Equal Opportunities DMV representative. This lecture series honors a female mathematician (German or working in Germany) who has made fundamental contributions to the mathematical sciences by inviting her to give a distinguished keynote lecture in the annual DMV conference. Also the German society of math education (GDM, see [8]) has a subunit called

Arbeitskreis Frauen und Mathematik which is mainly concerned with gender-specific issues in math education. This subunit was founded in 1989 and it organizes an annual meeting every autumn (for more information see [9]).

Several thematic local meetings aimed to encourage female researchers working in a particular area of Mathematics are also taking place all over Germany. At a local level, one example in which I am personally involved as current coordinator together with Salma Kuhlmann is the project *Konstanz Women in Mathematics (KWIM)* (for more information see [9]). This initiative is supported by the Equal Opportunity Council of the University of Konstanz [10] since May 2013 and aims to promote female mathematicians at all levels. Among the KWIM activities are: a lecture series aimed to present mathematical results/biographies of female mathematicians and/or their own experience in academia, an annual meeting in Konstanz, sponsoring the participation of local female researchers/students in national and international meetings in the framework of Women in Mathematics.

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