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Contrasting Global Gender Gaps in STEM interests on Facebook with Offline Gender Gap Indicators

Gender Gap, Education, STEM, Social Media data, Facebook Ads

Extended Abstract

The rapid advance in technology is disrupting industries and the job market, creating a growing demand for STEM – Science, Technology, Engineering, and Mathematics – talents. The pandemic also accelerated the digital transformation, but the impact is not the same for all cultures, ethnic groups, and genders. In particular, the gender gap trends persist, and the number of women in STEM-related fields is still lower than the number of men [4].

Even though there are efforts to reduce the gender gap in STEM areas, the process toward parity has a slow pace. Most of the studies focusing on the gender gap are based on surveys [2, 3]. Overall, these studies require a lot of time and costs needed to run surveys. Besides that, the main focus is on the gender gap at the educational and the labor market level with less focus on a broader level considering people's preferences and interests. To overcome such limitations, we propose the use of social media data as a complementary approach to assess the gender balance across people's interests in STEM and non-STEM majors.

In this paper, we present a large-scale analysis of the STEM gender gap across the globe. We use data collected from the Facebook Advertising Platform (Facebook Ads) to measure the gender gap across interests in STEM majors. Facebook is still the biggest social media with the highest number of active users, especially among young people [1]. By using Facebook data, our study focuses on a broader audience, including users who are not necessarily enrolled or working in the STEM field. We analyze the STEM gender gap globally and consider a broader number of STEM and non-STEM interests associated with college majors. We capture the interest of STEM and non-STEM subjects using college majors to better observe the nuances across the different fields. This study is important to understand the gender gap at the level of users' interests regardless of their professional or educational level.

We measure the gender gap across STEM and non-STEM majors by applying the following methodology. First, we downloaded a list of college majors from the Handshake website.The platform provides a list containing 177 college majors classified along 15 areas of knowledge. After obtaining a list of 177 college majors from the Handshake website, we query the Facebook Ads API to obtain estimates of the audience size interested in each one of the 142 college majors available on Facebook Ads across 198 countries[1]. Next, we measured the Overall Gender Balance (OGB), which corresponds to the proportion of male Facebook users in a country, and the Gender Balance (GB) across STEM and non-STEM majors. The GB score is defined in terms of the proportion of male Facebook users interested in a specific major. The GB scores range from 0 to 1, in which a value of 0.5 indicates gender parity and high or low values represent the male or female majority, respectively.

Figure 1a shows the OGB values across countries. Countries in red have the lowest proportion of men, and countries in blue have the highest proportion of men. Countries in gray

[1]The countries excluded from this study are those where the use of Facebook is restricted (see `https://www.facebook.com/business/help/1155157871341714?id=176276233019487` or with a small number of users (i.e., below 1,000 which corresponds to the lower bound imposed by Facebook Ads for privacy reasons).

color correspond to countries where we could not collect any data from Facebook. The OGB metric varies from 0.39 in Belarus to 0.85 in Yemen. In most countries, the female audience is larger than the male audience, except in some countries in Africa and Asia. Figure 1b shows the median of the GB values for all college majors across countries. The GB varies from 0.37 in Georgia to 0.65 in Ethiopia. We found that in most countries the proportion of women on Facebook interested in college majors is higher than men, except for a few countries in Africa and Asia. Figures 1c and 1d show the median GB values for each group of majors, STEM and non-STEM, respectively. By comparing these two figures, we observe that the GB values are mostly higher for STEM college majors than for non-STEM college majors, suggesting that in most countries, the number of men interested in STEM is higher than women.

While the highest proportion of Facebook users interested in non-STEM majors is women, most of the Facebook users interested in STEM majors are men. However, among those majors classified as STEM, we observed some differences, such as Life Sciences and Math being more popular among women and Engineering and Technology being more popular among men. For non-STEM majors, we notice that Economics and Business, History, Government, and Journalism majors are more popular among male Facebook users than females. This result is important to emphasize that although the gender gap is higher across STEM majors, the high gender gap is not homogeneous across majors within STEM.

We contrasted our STEM gender balance estimates with the Global Gender Gap Index (GGGI) [5]. The GGGI values range from zero (disparity) to 1 (parity). Our results include measures of gender balance across 48 countries not covered by the official report. For those 152 countries in the overlap of both datasets, we observed a strong negative correlation association between our measures using Facebook data and the GGGI. The negative correlation suggests that in countries where the gender disparity is high (i.e., low GGGI), there are more men than women interested in college majors on Facebook, especially across non-STEM majors (corr. = -0.4). Finally, our results show the feasibility of using Facebook data to measure the global gender gap, in particular across college majors.

References

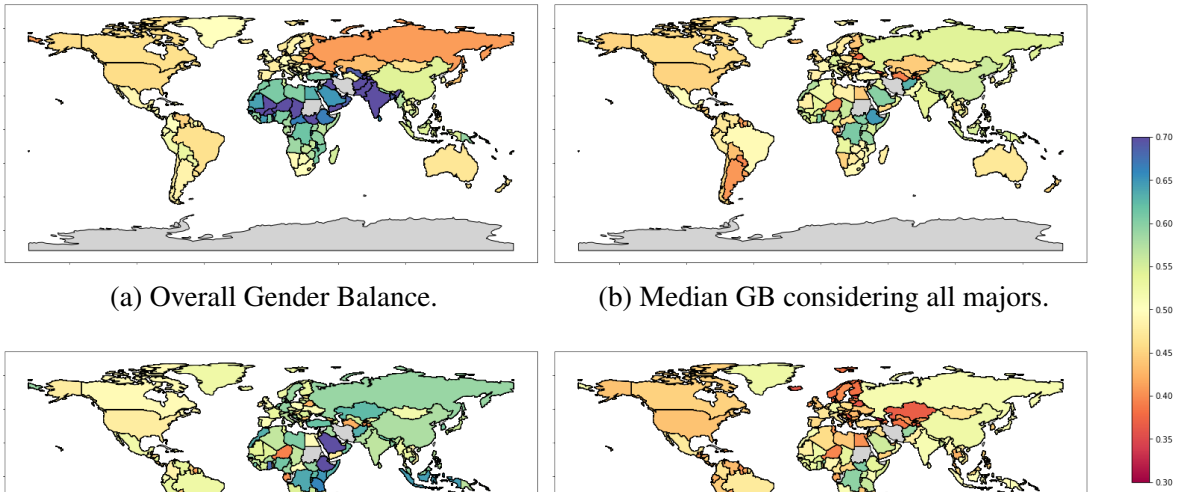
[1] Maeve Duggan, Joanna Brenner, et al. *The demographics of social media users, 2012*, volume 14. Pew Research Center's Internet & American Life Project Washington, DC, 2013.

[2] Michaela Marth and Franz X Bogner. Monitoring a gender gap in interest and social aspects of technology in different age groups. *International Journal of Technology and Design Education*, 29(2):217–229, 2019.

[3] Verena Tandrayen-Ragoobur and Deepa Gokulsing. Gender gap in stem education and career choices: what matters? *Journal of Applied Research in Higher Education*, ahead-of-print, 05 2021.

[4] UNESCO. Women a minority in industry 4.0 fields. `https://www.unesco.org/en/articles/women-minority-industry-40-fields`, 2021. Accessed: 2022-08-08.

[5] WEF. Global gender gap report. `https://www.weforum.org/reports/global-gender-gap-report-2021`, 2021. Accessed: 2022-09-14.



(a) Overall Gender Balance.

(b) Median GB considering all majors.

(c) Median GB of all STEM majors.

(d) Median GB of all non-STEM majors.

Figure 1: Overall Gender Balance (OGB) and Gender Balance (GB) across countries. Countries are colored from the highest proportion of women in red to the highest proportion of men in blue. We do not have information about the countries in gray.