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Characterizing Global Gender Gaps in STEM Using Facebook Data

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Abstract

Despite progress in addressing gender inequality in education and labor market, fields such as Science, Technology, Engineering, and Mathematics (STEM) remain far from achieving gender parity. The COVID-19 pandemic accelerated digital transformation and increased the demand for STEM professionals, yet gender disparities in the workforce persist. Monitoring these gaps globally is essential for understanding emerging trends and informing policy. However, traditional data sources are often limited by cost, scope, and availability. In this study, we explore Facebook Ads data as a scalable and timely alternative for assessing gender disparities in interest in STEM-related field. We analyze user data from 198 countries across 142 Facebook interests linked to both STEM and non-STEM college majors. Our findings reveal that, in most countries, more Facebook users self-report as female than male. Nevertheless, male users express greater interest in STEM majors — especially Engineering and Technology—while female users tend to show higher interest in Life Sciences and Mathematics. Furthermore, we observe that countries with a lower proportion of male users interested in college majors tend to perform better on official gender gap indicators based on survey data. These findings highlight the potential of social media data as a complementary resource for monitoring global disparities in education and career interests.

Introduction

Rapid technological advances have disrupted industries and the job market, amplifying the global demand for STEM – Science, Technology, Engineering, and Mathematics – professionals (UNESCO, 2021). The COVID-19 pandemic has accelerated digital transformation; however, the observed impact varies across cultures, ethnic groups, and genders. Despite growing initiatives that aim to promote inclusion, women remain underrepresented in many STEM-related occupations, especially in high-tech sectors (WEF, 2016). Diverse representation in STEM is essential not only for equity but also for fostering innovation and economic resilience. Prior research highlights that teams with greater gender diversity tend to perform better and drive stronger business outcomes (Forbes, 2018; Gompers & Kovvali, 2018).

Despite ongoing efforts to narrow the gender gap in STEM, some initiatives seem ineffective, and progress toward parity is slow. For greater impact, strategies must consider the cultural specificities of each country or region (WEF, 2021) as well as disciplinary differences. Gender gap statistics often mask disparities within STEM fields. In the U.S., for example, women earn over half of undergraduate degrees in

Biology, Chemistry, and Mathematics, but only 20% graduate from fields such as Computer Science, Engineering, and Physics (Cheryan et al., 2016; Munoz-Boudet & Revenga, 2017).

Most studies on gender gaps rely on surveys (Garcia-Holgado & Garcia-Penalvo, 2022; Tandrayen-Ragoobur & Gokulsing, 2021), which require significant time and financial resources. Also, these studies tend to focus on gender gaps in education and labor markets, with less emphasis on preferences. On a global scale, consistent data collection is difficult, and statistics for many countries, especially in the Global South, remain scarce. To address these limitations, we explore the use of social media data to assess gender balance across users' interests in STEM and non-STEM majors. In this paper, we present a large-scale analysis of the global STEM gender gap using data from Facebook Advertising Platform (Facebook Ads), where gender is self-reported by users in their profiles.

Throughout this paper, we use the terms *female/male users* to refer to individuals on Facebook who self-report their gender as female or male. While these labels reflect the binary options provided by the platform, they do not necessarily correspond to gender identity. We use *women/men* when referring to offline data sources or broader gender-related discussions to maintain consistency with those sources.

Facebook Ads data is widely used in various contexts, including assessing population health (Araujo et al., 2017), inferring political views (Guimarães et al., 2021), measuring cultural similarities (Vieira et al., 2022), predicting migration patterns (Alexander et al., 2019; Palotti et al., 2020), and conducting gender gap assessments (Garcia et al., 2018; Mejova et al., 2018; Vieira & Vasconcelos, 2021). Our study provides a global analysis of gender gaps in interest across a broad set of STEM and non-STEM interests associated with college majors.

As part of our methodology, we curated a list of Facebook interests associated with college majors in both STEM and non-STEM fields. Then, we collected the estimated number of Facebook users expressing interest in each major across multiple countries. To evaluate gender gaps, we derived two measures: the Overall Gender Balance (OGB) and the Gender Balance (GB). OGB represents the proportion of male Facebook users in a given country, while GB quantifies the proportion of male users in that country interested in a specific major. We applied these metrics to analyze variations in gender gaps across 142 college majors in 198 countries.

Our findings reveal a contrast between interests related to STEM and non-STEM majors. While Facebook users interested in non-STEM majors are predominately female, users interested in STEM majors are predominately male. However, within the STEM, differences emerge; for instance, Life Sciences and Math attract relatively more female users, whereas Engineering and Technology are more popular among male users. Non-STEM majors, such as Economics, Business, History, Government, and Journalism are also more commonly associated with male Facebook users.

To validate our findings, we contrasted STEM gender balance estimates from Facebook with data from the 2021 Global Gender Gap Report (WEF, 2021). Our approach enabled the inclusion of 48 countries not covered by the official report.

Among the 152 countries with overlapping data, we observed a correlation between higher offline gender parity and a greater proportion of female users interested in college majors, particularly in non-STEM fields. These results support the viability of using Facebook data as a complementary source for monitoring global gender disparities.

Related Work

According to UNESCO, young women account for only 25% of students in engineering, manufacturing, and construction or information and communication technology in over two-thirds of countries in 2020 (UNESCO, 2020). This STEM gender gap is linked to factors tied to women's self-perception within their social context (Botella et al., 2019; Garcia-Holgado & Garcia-Penalvo, 2022). Initiatives to boost women's recruitment and retention in STEM propose measures to alleviate social identity threats, such as training teachers to encourage STEM vocations in young women and implementing gender-inclusive policies (Garcia-Holgado & Garcia-Penalvo, 2022; Moss-Racusin et al., 2021).

The gender gap in STEM is predominantly examined through surveys (Garcia-Holgado & Garcia-Penalvo, 2022; Tandrayen-Ragoobur & Gokulsing, 2021). For instance, Tandrayen-Ragoobur and Gokulsing (2021) conducted surveys targeting undergraduate students and women working in STEM fields, identifying factors such as family environment, teacher-student relationships, and a sense of community as key influences in shaping career choices. Similarly, Garcia-Holgado and Garcia-Penalvo (2022) developed a model aimed at improving women's attraction to, access to, and retention in STEM within higher education institutions, based on survey data collected in Latin American countries.

Despite their importance, surveys require considerable time and financial resources. As a scalable alternative, researchers have turned to Facebook Ads data to assess diverse demographic characteristics using advertisement audience estimates. This approach has been applied to study lifestyle diseases (Araujo et al., 2017), rural-urban inequalities in difficult-to-reach Italian population groups (Rama et al., 2020), cultural influences on migration across countries (Vieira et al., 2020, 2022), and gender inequality (Al Tamime & Weber, 2022; Kashyap et al., 2020; Vieira & Vasconcelos, 2021). Gender gaps on Facebook serve as proxies for broader gender inequalities (Weber et al., 2018). Garcia et al. (2018) noted that countries with a low Facebook gender gap correlate with increased economic gender equality. Kashyap et al. (2020) found a strong correlation between gender gaps in internet use, low-level digital skills indicators, and data from Facebook and Google Ads.

In the context of measuring gender gaps, Vieira and Vasconcelos (2021) used Facebook data and interests related to college majors to assess the gender disparities in STEM majors in Brazil. Their findings revealed significant variations in the gender gap among different STEM majors, influenced by women's education level and age. Building on this, Al Tamime and Weber (2022) explored the potential of Facebook and Instagram Ads data to model the decline of the gender gap in STEM across different age groups. The study focused on U.S. cities, utilizing APIs filtered by age, gender, and STEM interests. While noting the limitations of social media

advertising data, the study was restricted to a single country and generic interests. To overcome these limitations and account for well-documented gender differences in preferences (Falk & Hermle, 2018), including those observed on Facebook (Cuevas et al., 2021), our study collected data on 142 STEM and non-STEM interests associated with college majors across 198 countries.

Data and Methods

Our methodology builds on prior research by Vieira and Vasconcelos (2021), extending their approach from a national to a global context. We use Facebook Ads data to estimate the gender balance of users interested in STEM and non-STEM college majors across 198 countries.

STEM and non-STEM college majors: STEM refers to majors in Science, Technology, Engineering, and Mathematics. However, definitions of STEM vary across educational, political-social, and personal contexts (Aguilera et al., 2021; Manly et al., 2018). In this study, we adhere to the classification from the National Center for Education Statistics (NCES)[1] to label college majors as STEM or non-STEM. We retrieved a list of 177 majors, categorized into 15 knowledge areas, from the Handshake platform[2]. We then used the Facebook Ads API to obtain audience size estimates for each of these majors.

Selection of countries: We included all 198 countries where Facebook is available and has a sufficiently large user base. Countries where Facebook is restricted[3] or where a given interest had fewer than 1,000 users (in line with Facebook Ads' privacy-mandated thresholds) were excluded.

Facebook Marketing API

The Facebook Marketing API[4] provides estimates of Monthly Active Users (MAU) segmented by demographic attributes, like age, gender, home location for those who stated location in their Facebook profile, and interests (Kosinski et al., 2015). From 177 majors listed by Handshake, we collected data on 193 related interests on Facebook. To refine the dataset, we remove ambiguous or too generic interests (e.g., Music and Photography). We also excluded interests with audiences below 1,000, resulting in a final set of 142 Facebook interests — 66 categorized as STEM and 76 as non-STEM — based on the NCES taxonomy, as shown in Table 1. Users' interests, as inferred or declared on the platform, are used as a proxy for their preferences towards specific fields of study.

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[1] https://www.ice.gov/doclib/sevis/pdf/stemList2022.pdf

[2] https://support.joinhandshake.com/hc/en-us/articles/360019970434-List-of-Major-Groups

[3] https://www.Facebook.com/business/help/1155157871341714?id=176276233019487

[4] https://developers.Facebook.com/docs/marketing-apis

Table 1. College majors grouped into STEM and non-STEM.

	College Majors
STEM	Aerospace Engineering, Agriculture, Agronomy, Animal Science, Astronomy, Automation Engineering, Automotive Engineering, Aviation, Biochemistry, Biological Engineering, Biology, Biomedical Engineering, Biotechnology, Botany, Cartography, Cell Biology, Chemistry, Computer Engineering, Computer Programming, Computer Science, Computer Systems Networking, Construction Engineering, Construction Management, Cyber Security, Data Science, Earth Sciences, Ecology, Electrical Engineering, Energy Engineering, Environmental Engineering, Environmental Management, Epidemiology, Food Science, Forensics, Forestry, Genetics, Geography, Geology, Immunology, Industrial Engineering, Information Systems Management, Kinesiology, Landscape Architecture, Management Science, Marine Biology, Materials Science, Mathematics, Mathematics Education, Mechanical Engineering, Microbiology, Molecular Biology, Natural Resource Management, Network Engineering, Neuroscience Nuclear Engineering, Nursery, Oceanography, Physics, Plant Biology, Plant Sciences, Software Design, Soil Science, Statistics, User Experience, Veterinary Sciences, Zoology
Non-STEM	Accounting, Actuarial, Advertising, Agriculture Business, Agriculture Education, American Sign Language, Anthropology, Applied Arts, Architecture, Art History, Business Administration, Business Analytics, Classical Studies, Consulting, Consumer Science, Counseling, Criminal Justice, Criminology, Culinary Arts, Dentistry, Design, Early Childhood Education, Economics, Education Administration, Elementary Education, Emergency Management, Entrepreneurship, Ethics, Ethnic Studies, Exercise Science, Finance, Financial Management, Foreign Languages, Gender Studies, Government, Graphic Design, History, Homeland Security, Hospital Administration, Human Resources, Human Services, Industrial Design, Interior Design, International Business, International Studies, Journalism, Linguistics, Management, Marketing, Media Studies, Medicine, Music Education, Nursing, Nutrition, Occupational Therapy, Operations Management, Pharmacy, Philosophy, Physical Education, Political Science, Product Design, Psychology, Public Administration, Public Health, Public Policy, Public Relations, Religious Studies, Secondary Education, Social Work, Sociology, Special Education, Speech Pathology, Sport Business, Theatre Arts, Theology, Urban Planning

We collected the estimated number of MAU living in each country and interested in each one of the college majors. However, due to the Facebook API's minimum audience threshold, we excluded all college majors with an audience of fewer than 1,000 in a given country. As a result, the number of majors analyzed varies across countries. Figure 1 shows the number of college majors categorized into STEM and non-STEM for the top 50 countries with the highest available number of college majors (i.e., audience greater than 1,000). Notably, the U.S. and India lead in the number of majors and the proportion of STEM interests. Figure 2 shows the proportion of STEM majors within our final dataset of 142 interests (STEM and non-STEM majors) across countries. In most countries, the number of non-STEM college majors is higher than STEM college majors. However, some countries such as Turkmenistan and Yemen show high proportions of non-STEM interests.

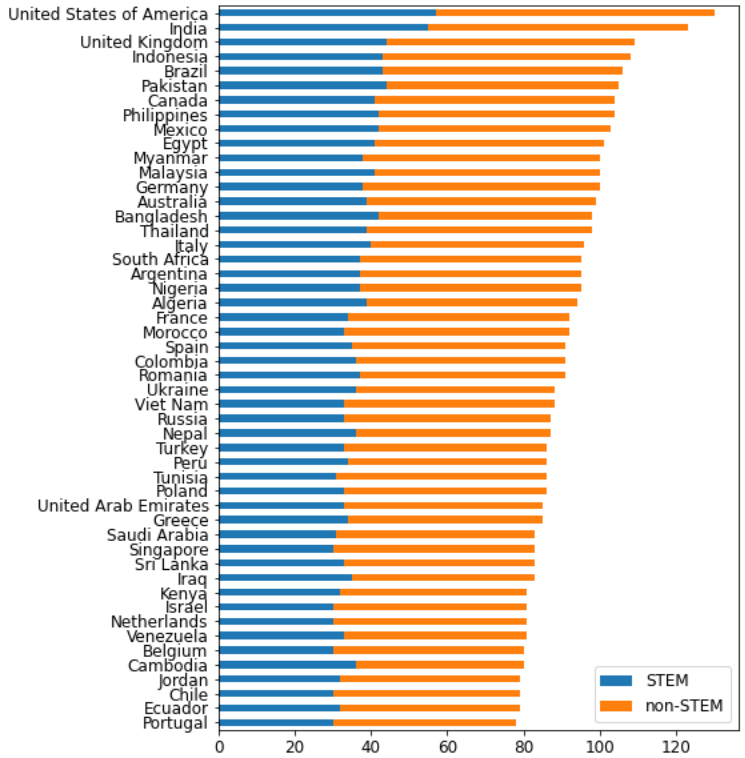

Figure 1. Number of STEM and non-STEM interests available on Facebook per country, depicted for the top 50 countries with over 1,000 MAU associated with college majors.

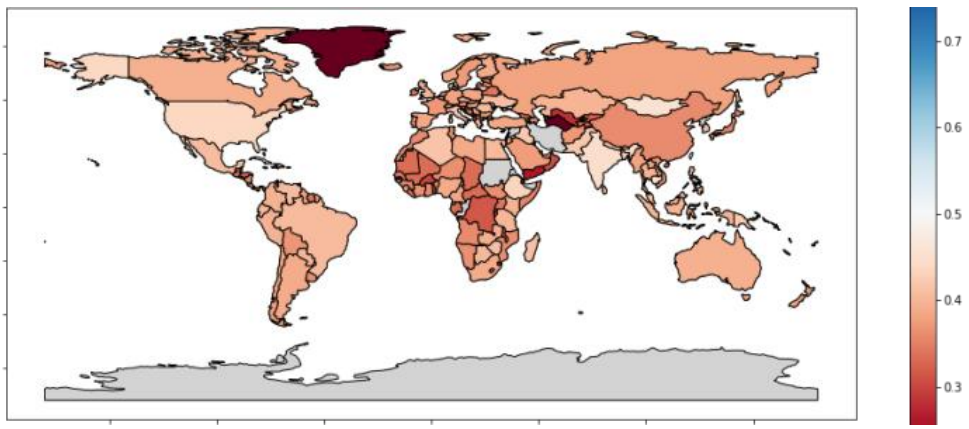

Figure 2. Proportion of STEM majors on Facebook. Colors range from dark red, indicating a higher proportion of non-STEM, to dark blue, indicating a higher proportion of STEM majors. Gray indicates countries with unavailable data.

Gender Balance Metric

To assess the global gender distribution among Facebook users, we compute the **Overall Gender Balance (OGB)**, defined as the proportion of male users in a given population □:

$$OGB_p = \frac{MAU_p(male)}{MAU_p(male) + MAU_p(female)}$$

To assess gender balance in college majors using Facebook users' interests, we adopt the Gender Balance metric proposed in prior studies (Haranko et al., 2018; Vieira & Vasconcelos, 2021). This metric quantifies the ratio of male users interested in a specific major relative to female users. Defining this metric requires specifying the target population. We compute this ratio at the country level and further disaggregate it by major (STEM vs. non-STEM) using additional demographic filters as needed from Facebook Ads. Given a population p, we compute the proportion of users with gender g interested in a college major m as:

$$A_p(g,m) = \frac{MAU_p(g,m)}{MAU_p(g)}$$

Normalization is crucial due to the prevalent imbalanced gender distributions, with more female Facebook users than male, as illustrated in Figure 3a. Subsequently, for the ongoing analysis, we adopt the normalized audience to assess the **Gender Balance (GB)** of a college major m within a population p as:

$$GB_p(m) = \frac{A_p(male,m)}{A_p(male,m) + A_p(female,m)}$$

The GB scores range from 0 to 1, with 0.5 indicating gender parity. Values higher than 0.5 indicate a male majority, while values lower than 0.5 indicate a female majority.

Gender Balance Analysis on Facebook

In this section, we present the OGB and the GB derived from Facebook Ads users' interests in college majors across countries. We start by showing the overall gender balance proportions for each country.

Figure 3a shows OGB values across countries using a color scale that goes from dark red to dark blue. Redder hues denote lower proportions of male users (low OGB values), while bluer shades indicate higher male representation (high OGB values). We use gray to indicate countries with unavailable Facebook data. OGB ranges from 0.39 in Belarus to 0.85 in Yemen (OGB median = 0.51). In most countries, the female audience surpasses the male audience, aligning with prior findings (e.g., Gil-Clavel and Zagheni, 2019) that women are more engaged on the Facebook platform.

Figure 3b presents the median GB values across all majors for each country. GB values range from 0.37 in Georgia to 0.65 in Ethiopia (GB median = 0.48). Notably, 64% of countries exhibit GB scores below 0.5, indicating a higher proportion of female users interested in college majors on Facebook. Exceptions are mainly observed in countries across Africa and Asia. We observe a moderate positive correlation (Pearson's r = 0.45) between the OGB and GB (Figure 5).

Figures 3c and 3d show the median GB values for STEM and non-STEM majors, respectively. A comparison reveals that GB values tend to be higher for STEM than for non-STEM majors, suggesting that in most countries, male users show greater interest in STEM majors. 74% of countries show male-majority interest in STEM, with GB values ranging from 0.37 in New Caledonia to 0.71 in Saudi Arabia (GB STEM median = 0.57). For non-STEM majors, 72% of countries exhibit female-majority interest, with GB values ranging from 0.31 in Georgia to 0.6 in South Sudan (median GB non-STEM = 0.45; 75th percentile = 0.49), reinforcing the trend of greater female interest in non-STEM majors.

Overall, in countries where male users outnumber female users (as shown in Figure 3a), we observe a higher interest in STEM majors among male users (i.e., higher GB for STEM majors), particularly across North Africa and Asia. Only 48 countries have more female users interested in STEM majors (GB STEM < 0.5). For instance, Niger (OGB = 0.8 and GB STEM = 0.39), Tajikistan (OGB = 0.78 and GB STEM = 0.41), Togo (OGB = 0.7 and GB STEM = 0.45), and Yemen (OGB = 0.7 and GB STEM = 0.48) have more male than female Facebook users (i.e., high OGB) and more female than male users interested in STEM.

In contrast, Figure 3d shows that locations where female users are more interested in non-STEM majors also tend to have more male than female users on Facebook. Examples include Tajikistan (OGB = 0.78 and GB non-STEM = 0.38), Azerbaijan (OGB = 0.67 and GB non-STEM = 0.39), Egypt (OGB = 0.63 and GB non-STEM = 0.4), Niger (OGB = 0.8 and GB non-STEM = 0.4), Uzbekistan (OGB = 0.69 and GB non-STEM = 0.41), and Gambia (OGB = 0.66 and GB non-STEM = 0.42). Only 44 countries have median GB values for non-STEM majors higher than 0.5 (i.e., more male than female users are interested in non-STEM majors).

Finally, we find a moderate positive correlation between the two measures, OGB and GB, for both STEM (r = 0.3) and non-STEM (r = 0.45) majors (see Figure 5). Despite global variation in Facebook usage and the predominantly female-skewed user base (i.e., OGB < 0.5), our observations consistently show higher interest in STEM majors among male users (GB STEM > 0.5) and greater interest in non-STEM majors among female users (GB non-STEM < 0.5).

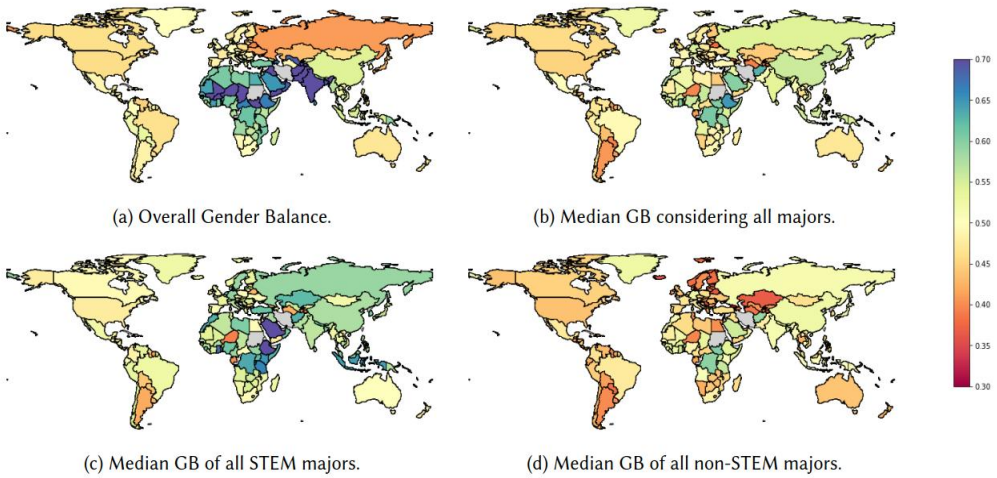

Figure 3. Overall Gender Balance (OGB) and Gender Balance (GB) across countries. Colors range from red, indicating a higher proportion of female users, to blue, indicating a higher proportion of male users. Gray indicates countries with unavailable data.

To provide more detail on the GB values for each major, we selected the top five countries with the highest number of majors (see Figure 1). Figure 4 displays GB values for each major, focusing on Facebook users from these five countries. Figures 4a and 4b illustrate STEM and non-STEM majors, respectively, using the same color scale as in Figure 3—redder and bluer shades represent a greater proportion of female and male users, respectively. White areas indicate majors in specific countries with insufficient Facebook data (i.e., a Facebook audience size of 1,000 users).

In both Figures 4a and 4b, around 60% of the cells show GB > 0.5 for STEM and GB < 0.5 for non-STEM, emphasizing that male users dominate interest in STEM majors, while female users are more interested in non-STEM majors. However, some STEM majors (e.g., Life Sciences and Mathematics) attract more female than male users.

Consistent with findings by Vieira and Vasconcelos (2021), we observe two distinct patterns across STEM majors: (i) Engineering and Technology interests are predominantly male-dominated (i.e., high GB), while (ii) Science and Math majors exhibit a high number of female users (i.e., low GB). This highlights that despite the overall gender gap in STEM, the pattern does not apply uniformly across all STEM majors. Therefore, when designing policies or interventions aimed at increasing female participation in STEM, it is essential to consider the variability in gender balance across different majors. Lastly, even within non-STEM majors, there are exceptions where male users outnumber female users (i.e., high GB), such as in Economics and Business, History, Government, and Journalism.

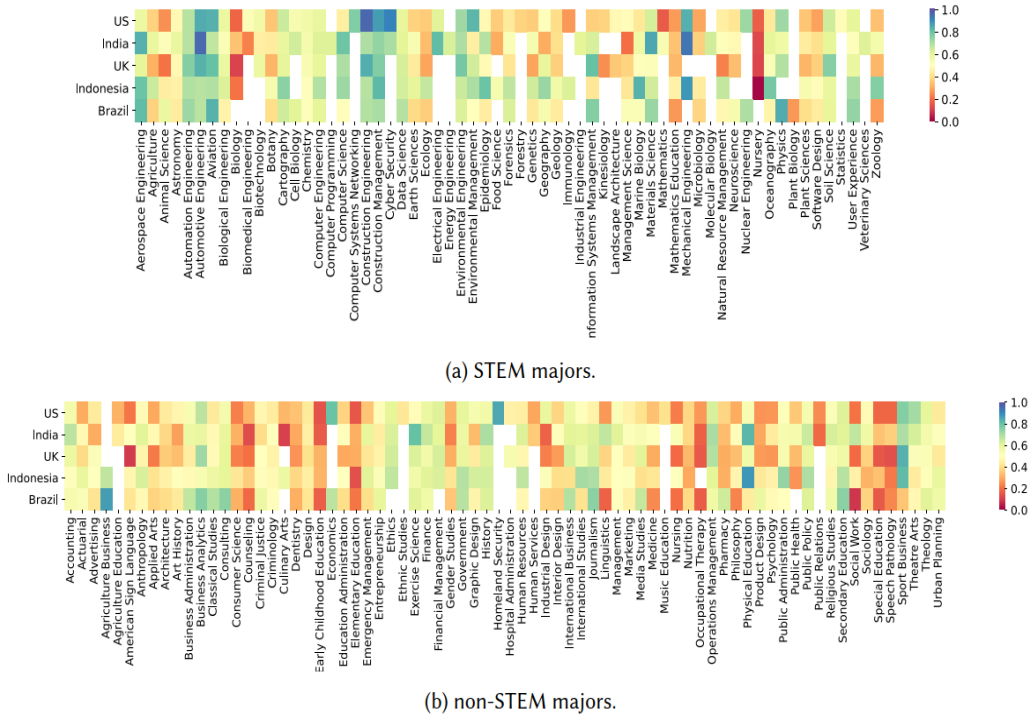

Figure 4. Gender Balance (GB) for each major in the top five countries with the highest number of majors. Colors range from red (lower GB) to blue (higher GB). White indicates unavailable data.

Contrasting online and offline gender gaps

The contrast between online and offline gender gaps can offer valuable insights into the interconnectedness of online and offline measures of gender gap and shed light on the effectiveness of using social media data to measure gender gaps. Offline indicators can provide a benchmark for assessing the extent to which social media data can capture the gender gap while also highlighting any methodological limitations.

To facilitate this comparison, we used data from the 2021 report provided by the World Economic Forum (WEF, 2021). The Global Gender Gap Index (GGGI) covers 156 countries and comprises four sub-indices: Economic Participation and Opportunity, Educational Attainment, Health and Survival, and Political Empowerment. GGGI values range from zero (complete disparity) to 1 (complete parity). Figure 5 presents Pearson's correlation coefficients between the gender balance indicators derived from Facebook data and the GGGI (including its sub-indices) for the 152 countries available in both datasets.

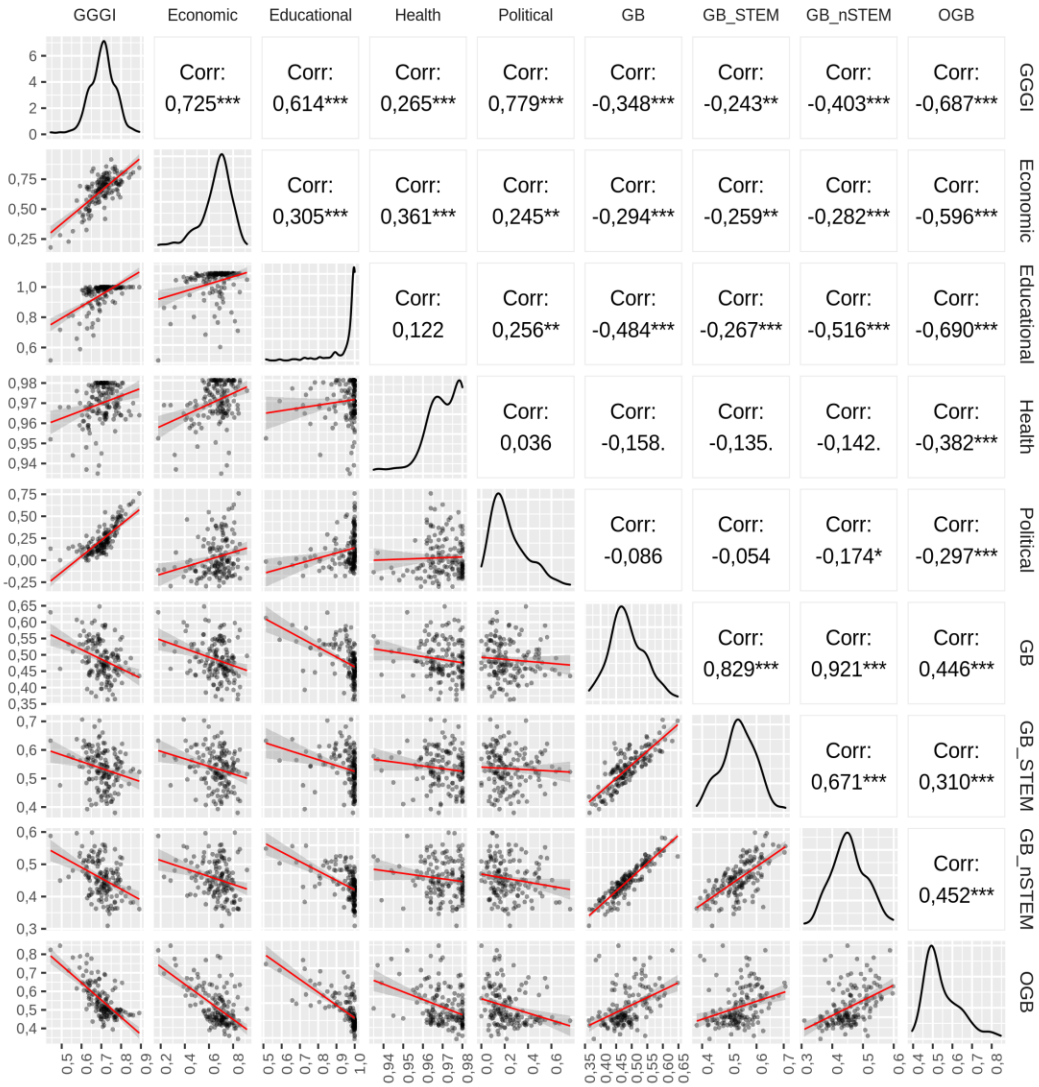

Figure 5. Correlations among Gender Balance (GB) measures based on Facebook data, the Global Gender Gap Index (GGGI), and its components: Economic Participation and Opportunity, Educational Attainment, Health and Survival, and Political Empowerment.

∗ ∗ ∗p < 0.001; ∗ ∗ p < 0.01; ∗p < 0.05

Facebook OGB and the GGGI show a strong negative correlation (r = −0.69). Countries with high GGGI values, such as Iceland, Finland, Norway, New Zealand, and Sweden, approach gender parity and have a higher proportion of female than male Facebook users (i.e., lower OGB). In contrast, countries with low GGGI values, such as Yemen and Afghanistan, have more male than female Facebook users. However, exceptions exist. Countries like Bangladesh, the United Arab Emirates, Burundi, Rwanda, Albania, and Mozambique demonstrate high levels of gender parity offline (high GGGI) but still have predominantly male Facebook users (i.e.,

high OGB), pointing to potential limitations in digital access or platform-specific dynamics.

We also find a moderate negative correlation between Facebook GB and the GGGI ($r = -0.35$), indicating that in countries with greater gender disparity (low GGGI), men are more likely to express interest in higher education majors online. The correlation is slightly stronger when focusing on non-STEM majors ($r = -0.4$), suggesting that in more gender-equal countries, female users show greater interest in non-STEM majors on Facebook.

As previously noted, countries with high GGGI values (e.g., Iceland, Finland, Norway, New Zealand, and Sweden) also exhibit some of the lowest GB values overall—especially in non-STEM majors—implying a larger presence of female users expressing academic interests. In contrast, Afghanistan stands out as a country with both low gender equality and a high proportion of male users interested in college majors (high GB). Yemen, however, represents an anomaly: despite a low GGGI, it has more female than male Facebook users interested in majors (i.e., low GB).

Finally, we found a low correlation between the GGGI and STEM GB values ($r = -0.24$). This may be due to the aggregation of STEM majors: high GB values in Engineering and Technology are counterbalanced by lower values in Life Sciences and Mathematics (see Figure 4). To capture these divergent patterns more accurately, future work should treat STEM as two distinct categories.

Discussion and Conclusion

This study uses Facebook Ads data to assess the overall gender balance and distribution of interest in STEM majors across 198 countries. Our findings confirm a general female user bias in the Facebook audience, consistent with previous research, with notable exceptions in specific African and Asian countries. While most countries exhibit a higher proportion of female users expressing interest in various academic majors, STEM majors show a predominance of male users in 74% of countries, in contrast to non-STEM majors, where female users dominate in 72% of cases. Within STEM, gender patterns vary substantially: Life Sciences and Mathematics attract more female interest, whereas Engineering and Technology remain male-dominated. Similarly, some non-STEM majors—such as Economics and Business, History, Government, and Journalism—tend to be more popular among male users.

Our study introduces a timely, cost-effective, reproducible, and scalable methodology to assess global gender disparities in STEM using digital trace data. These insights offer important implications for policymakers, industry leaders, and educational institutions aiming to address gender inequality. In future work, we plan to validate these findings against offline gender gap indicators and expand the scope to other social media platforms by utilizing their APIs to capture user-level attributes like gender, education, and interests.

Our analysis relies exclusively on publicly available data from the Facebook Marketing API, adhering to ethical guidelines (Rivers & Lewis, 2014). The data is aggregated and anonymized, ensuring compliance with Facebook's terms of

service[5]. While this approach demonstrates the feasibility of using Facebook Ads data for demographic research, several limitations remain. First, interests are either self-declared by users or inferred by Facebook based on behavioral signals (e.g., posts, likes, shares), and the exact inference mechanisms remain unclear. Despite this, we assume that users' interests in college majors on Facebook are a good proxy for studying the gender gap across disciplines.

Second, demographic attributes are restricted to those offered by the Facebook Ads Platform, treating gender as a binary variable. Third, our analysis focused on country-level gender balance without an age group breakdown. We aimed to maximize data coverage by avoiding requests that excessively narrow the Facebook audience. When the estimated audience size falls below Facebook's threshold of 1,000 users, the actual number could range from 0 to 1,000, introducing uncertainty. Fourth, cultural and contextual factors likely shape Facebook usage patterns, which may affect our results. Moreover, the classification of what constitutes a STEM field is itself contested. Definitions vary across stakeholders—such as educators, policymakers, and industry representatives—as well as by context, including immigration policies targeting STEM workers. For this reason, we designed a flexible and reproducible methodology that can accommodate different STEM classification schemes. We believe our results are largely robust to these definitional differences.

While platforms like LinkedIn might also offer valuable data for measuring gender gaps, they primarily reflect labor market participants (Najafikhah & Shamizanjani, 2018), which is outside the scope of this study. Facebook, by contrast, remains the world's largest social media platform—with particularly strong usage among young people (Duggan, Brenner, et al., 2013)—allowing us to capture a broader spectrum of users, including those not currently enrolled in or employed in STEM fields. By focusing on users' expressed interests rather than occupational or educational status, this study offers a complementary perspective on gender gaps in STEM interest.

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