Scientometrics (2024) 129:1719–1737
https://doi.org/10.1007/s11192-024-04945-0

Gender differences in google scholar representation and impact: an empirical analysis of political communication, journalism, health communication, and media psychology

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Received: 1 June 2023 / Accepted: 17 January 2024 / Published online: 16 February 2024

Abstract
Improving gender equality in top-tier scholars and addressing gender bias in research impact are among the significant challenges in academia. However, extant research has observed that lingering gender differences still undermine female scholars. This study examines the recognition of female scholars through Google Scholar data in four different subfields of communication, focusing on two pressing issues: (1) gender representation among the most cited scholars and (2) gender differences in citations. Our findings demonstrate significant differences in gender proportions among the most cited scholars across all subfields, but especially in Political Communication and Journalism. The regression analysis revealed significant differences in citation scores in Political Communication, Journalism, and the pooled sample. However, results revealed that gender differences in research impact were not statistically significant in Health Communication and Media Psychology. Our study advocates for shifts in the citing behavior of communication scholars, emphasizing the importance of actively recognizing and citing studies conducted by female researchers to drive advancements in communication research.

Keywords Google Scholar · Matilda effect · Gender bias · Citations · Productivity

Research evaluation frameworks play a crucial role in "objectively" measuring scientific meritocracy (Kamdem et al., 2019; Khan et al., 2022), especially since the number of open academic positions is not keeping pace with the growing number of PhD graduates (Cyranoski et al., 2011). Although there are great concerns about evaluation processes' fairness and procedures, scholars have been positively or negatively evaluated by these institutions in many countries (Lawrence et al., 2014; Park & Gordon, 1996). However, decades of field research have shown that beyond personality traits, such as talent or curiosity, individual and structural factors may also significantly influence different dimensions of scientific performance, such as productivity and impact (Cameron et al., 2016; Dion et al., 2018). In

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this study, we focus on one of the most important structural factors that might affect scholars' recognition, namely *gender roles*.

Extant research has systematically examined gender roles and their possible effects on sex bias in scientific productivity and impact (Knobloch-Westerwick & Glynn, 2013). One of the most important theoretical pillars of studying academic gender bias is the *Matilda effect*, which posits that female scholars suffer lingering structural inequalities that constrain their career prospects (Rossiter, 1993). Scholars have explored the Matilda effect from different research angles, such as females' and males' research performance, impact, gender ratios of authors in academic publications, decisions on tenure track positions, or the likelihood of being funded (Dion et al., 2018; Freelon et al., 2023; Huang et al., 2020; Knobloch-Westerwick & Glynn, 2013). This article complements this research tradition and focuses on citations, one of the most important factors in heuristically estimating scientific impact (Judge et al., 2007). Citation counts are ultimate elements that might affect hiring, promotion, and grant decisions (Cameron, 2005; Feeley & Yang, 2022; Holden et al., 2005; Toutkoushian, 1994).

Although several studies have examined the Matilda effect in the field of communication (Feeley & Yang, 2022; Freelon et al., 2023; Knobloch-Westerwick & Glynn, 2013; Knobloch-Westerwick et al., 2013), little is known about how gender differences unfold in Google Scholar, one of the most important platforms to openly disclose scholars' research impact across fields and research topics (Marsicano et al., 2022). Accordingly, focusing on four different subfields of communication research (Political Communication, Journalism, Health Communication, and Media Psychology) the aim of this paper is twofold: (1) to examine gender proportions among the most cited scholars within and across these subfields and (2) to explore gender differences in their citation counts.[1]

Analyzing these research fields is important because of the particularly marked struggle in social sciences to achieve a dominant position in knowledge production (de Sousa Santos, 2018; Wallerstein, 1999) an aspect which, according to extant research, harms the recognition of females' scientific contributions in communication research (Knobloch-Westerwick & Glynn, 2013; Knobloch-Westerwick et al., 2013). We analyze the fields of Political Communication, Journalism, Health Communication, and Media Psychology, because the former two disciplines are closer to "masculine" fields, while the others are closer to "feminine" topics in the sense of the role congruity theory (Knobloch-Westerwick & Glynn, 2013; Knobloch-Westerwick et al., 2013). Therefore, we aim to find out whether females are under-recognized in "masculine" and "feminine" subfields considering their presence (e.g., the number of women scientists) and impact (citation counts) among the top-cited researchers in Google Scholar.

Google scholar: A novel star

Generally, scholars use various academic search engines for research purposes (Gusenbauer, 2019). Google Scholar, launched in 2004, is interesting in particular because it is estimated to be the most comprehensive scientific search engine, with more than 389 million records (Gusenbauer, 2019). In addition, Google Scholar provides metadata for and/or

[1] We utilize capital letters in the terms "Political Communication, Journalism, Health Communication, and Media Psychology" because we refer to the research fields and not the related phenomena.

the full text of scientific literature, and tracks citations, including self-citations, h-, and i-10 indexes (Singh et al., 2022).

Due to its growing popularity, researchers compared Google Scholar's citation counts to other databases, such as Web of Science and Scopus (Amara & Landry, 2012; Etxebarria & Gomez-Uranga, 2010; Franceschet, 2010; Harzing & Alakangas, 2016; Mikki, 2010; Mingers & Lipitakis, 2010; Wildgaard, 2015). Franceschet (2010) outlined that Google Scholar detects a significantly higher number of citations and h-indexes than Web of Science, probably due to Google Scholar's more inclusive crawling methods. Mingers and Lipitakis (2010) compared citation numbers in Google Scholar to the same metrics in Web of Science in the research fields of Business and Management. They suggested that Web of Science should not be taken into account in citation-based evaluations in social sciences because it covers less than half of the journals, papers, and citations detected by Google Scholar (Mingers & Lipitakis, 2010).

In line with the above results, Wildgaard (2015) found that Web of Science and Google Scholar provided remarkably different numbers of citations and publications and detected diverging numbers of co-authors in Astronomy, Environmental Science, Philosophy, and Public Health. Consequently, Wildgaard (2015) emphasized that extreme caution is needed when considering *only one* of the aforementioned databases to evaluate the scientific impact because "the same indicators calculated for the same scholar, but in two different databases, might provide a different picture of the scholar's impact" (Wildgaard, 2015, pp. 897–898). In contrast, another research (Mikki, 2010) revealed that Google Scholar detected 85% of Earth Science documents that emerged in the Web of Science and showed that the number of citations and h-indexes were very similar in the two databases. Harzing's and Alakangas' (2016) longitudinal and cross-disciplinary analysis also found that Web of Science, Scopus, and Google Scholar provided stable and consistent growth in publication and citation metrics, suggesting that all of these databases have the stability of coverage that is necessary for more in-depth cross-disciplinary comparisons.

Regarding recent studies, Thelwall and Kousha (2017) revealed that Google Scholar collects more citations than ResearchGate, Web of Science, and Scopus. They also argued that Google Scholar and ResearchGate might not utilize different data sources for indexing citations because their citation counts strongly correlate with each other's metrics (Thelwall & Kousha, 2017). Singh and colleagues (2022) found that Google Scholar outperformed ResearchGate in citation metrics when they analyzed highly cited authors. They outlined the possible reasons why Google Scholar is "more successful" in crawling citations. Two of these reasons are crucial. First, Google Scholar has a more universal and less stringent indexing policy that collects a wide range of electronic documents: it crawls both peer-reviewed articles and the grey literature. Second, while Google Scholar automatically assigns a publication to a researcher, ResearchGate "sometimes fails to automatically attribute publications to the correct author" (Singh et al., 2022, p. 1535). Finally, researchers also found that scientists have more impressive bibliometric results in Google Scholar than in Scopus (Marsicano et al., 2022). The explanation relied again on the extensive search methods that Google Scholar implements (Marsicano et al., 2022).

Even though Google Scholar's popularity is perceived and acknowledged, it also has some pitfalls (Marsicano et al., 2022). First and foremost, Google Scholar was criticized for containing specific types of "errors," such as including non-scholarly documents (Jacsó, 2012a). In addition, researchers observed that Google Scholar might duplicate documents, thus potentially inflating citation scores (Doğan et al., 2016; Jacsó, 2006b). Consequently, Jacsó (2006a) suggests that Google Scholar is "good for locating relevant items, leading users some of the time to an open access version of a document, but it is not an appropriate tool for bibliometric studies" (p. 307) because it " plays fast and loose, (make that too fast and too loose), with its hit counts and citation counts to allow fair comparisons without tiresome verification" (p. 307). However, scholars found that double citations originating from redundant versions of the same paper occur in less than 2% of the observed cases on this platform (Moed et al., 2016). Finally, bibliometric information may overlap in Google Scholar if the imported data is incorrectly added to research profiles where scholars have identical names or surnames.

Even though researchers highlight that Google Scholar utilizes questionable and opaque indexing methods (Jacsó, 2005, 2012b), the relevance and magnitude of this academic search engine are difficult to disregard. Therefore, we argue that analyzing the Matilda effect in representation and citations within Google Scholar is an important step toward a better understanding of potential gender bias in the subfields of communication studies. For that, as to the best of our knowledge no previous analyses addressed the Matilda effect within Google Scholar with regards to communication science, by doing so we offer fresh insights into the representation and citation patterns of the field considering one of the most important platform for research evaluation. In the subsequent sections, we introduce the significance of analyzing top-cited scholars, as well as the Matilda effect among these researchers and in citations before we outline our research questions.

The significance of analyzing top-cited scholars

The examination of the most cited scholars within a specific field plays a pivotal role in understanding the development of sciences, shedding light on the overall state of knowledge production. Examining the top-cited scholars allows for the identification of individuals who wield significant influence in steering the direction of a field. Their work is often at the forefront of new (methodological and/or theoretical) developments within their respective disciplines, shaping the intellectual evolution of scientific fields (Kwiek, 2018). By focusing on the most cited scholars, this study, while recognizing the broader complexities and potential limitations associated with this approach, offers insightful findings on the gender representation and gender differences in citations in one of the most important collectives in shaping the course of science (Bolkan et al., 2012; Cucari et al., 2023).

Matilda effect in authorship and citations

In 1968, Merton introduced the Matthew effect, which focuses on two intertwined phenomena: the over-recognition of top scholars and the under-recognition of lesser-known scientists. The Matthew effect outlines that acknowledged scientists gain enhanced visibility while their less recognized peers' contributions fade away (Merton, 1968). This paper's primary theoretical background is a phenomenon entitled the Matilda effect—a term coined in relation to the Matthew effect—which presumes that female scientists are less recognized than their male colleagues (Rossiter, 1993). For instance, studies have proved that, as they reviewed progressively higher academic positions, they found a constant decrease in the number of female scholars in these roles (European Commission, 2012; National Academy of Sciences, 2007; van den Besselaar & Sandström, 2017). Research also showed that female scholars win smaller grants than their male colleagues (RAND Corporation, 2005) and receive scholarships with considerably less frequency than male scientists (Bornmann et al., 2007; Lerchenmueller & Sorenson, 2018; Liao & Lian, 2022; van den Besselaar & Leydesdorff, 2009). It is important to note, however, that many studies found no gender bias in publishing, hiring, and being funded (Ceci & Williams, 2011; Ley & Hamilton, 2008; Liao & Lian, 2022).

A vital question emerges at this point: what factors might fuel the Matilda effect? The answer relies primarily on socially constructed, structural reasons. Considering the literature on gender bias in science, the relevant theoretical background is rooted in social role theory, whereby scholars argue that gender is socially constructed via gender roles (Eagly, 1987). These roles implement normative expectations from males and females and suggest the desirable behavior for men and women (Eagly, 1987). The social role theory suggests that *communal* characteristics mostly suit women while *agentic* ones are generally desirable for men (Eagly, 1987). Specifically, communal characteristics imply helpful, caring, and sympathetic attitudes towards other people's well-being, while agentic characteristics are typical of competitive, ambitious, self-confident individuals with strong leadership skills (Knobloch-Westerwick et al., 2013). At this point, an important segment of the theory, the *role congruity theory*, kicks in.

The role congruity theory helps scholars analyze the congruity between gender roles and other roles, such as the scientific one (Eagly & Karau, 2002). Role congruity theory suggests that scientific roles are agentic, and therefore are closer to "male" characteristics, implying ambition, leadership, and self-confidence (Knobloch-Westerwick & Glynn, 2013). On the other hand, role congruity theory highlights that communal roles—such as taking care of children and ill people—are not compatible with the scientific role. Consequently, beliefs about the scientist and female roles are not compatible, which leads to competition between these role-based expectations. Role incongruity might harm female scientists by causing them to be judged negatively in academia. As a result, the social–psychological incongruity might attract negative evaluations or reduce the willingness to invite female scientists to research networks (Knobloch-Westerwick et al., 2013). These structural circumstances can reduce the duration of females' careers and harm their productivity, because structural factors such as negative stereotypes towards women, exclusion from informal networks of communication, and the lack of professional mentors might be due to role incongruity (Cech & Blair-Loy, 2014; Huang et al., 2020).

Beyond the well-known structural reasons, other explanations might also be relevant in examining the Matilda effect. One of the most comprehensive papers on sex differences analyzed 1.5 million authors and found that women account for 27% of authorship in the research fields of science, technology, engineering, and mathematics (Huang et al., 2020). Researchers explained the above difference with different *dropout rates* for females at every stage of their careers (Huang et al., 2020). Dropout rates might be higher for women than men because females report exclusion from colleagues, aggressive behavior from students, and sexual harassment during their faculty work more often than males (Bronstein & Farnsworth, 1998). Another research (Leahey, 2006) suggested that specialization supports productivity, but that female sociologists tend not to focus on a single research field because they feel that narrowing down their research scope would harm their competitiveness when they try to move to other institutions or departments. Duch et al. (2012) argue that female scholars' lower publication rates are possibly due to the fact that women gain less institutional support in research resource amounts than their male peers.

Extant research also found that women participate significantly less in international research collaboration than men (Uhly et al., 2017). Importantly, the above study also revealed that family status can create an invisible "glass fence" that harms females' academic careers if women have partners who do not work in academia (Uhly et al., 2017).

Jadidi et al. (2018) argue that female scholars are less prolific than men because they work with a smaller fraction of senior authors than males, narrowing women's research networks. The study revealed that successful male and female scholars had the same collaborative behavior: both groups work with "highly-connected scientists" (Jadidi et al., 2018, p. 18) who produce many peer-reviewed papers with high quality. Van den Besselaar and Sandström (2017) argue that the Matilda effect in production is explained by the facts that (1) male scholars are older in general and have more time to publish and (2) men have higher academic positions. The above study suggests that the higher academic position scholars have, the more prolific they are, and women are in a disadvantaged position in that competition.

As for the field of communication, a recent study has found that the number of female first authors grew significantly between 2009 and 2019, but their proportion among the top-cited authors did not grow at a similar pace (Author et al. 2022). More specifically, even though the share of female scholars (57%) was larger in 2019 than their male counterparts' ratio in communication research, males outperformed (58%) their female peers' shares in the first authorship among the top-cited researchers (Author et al., 2022). Even though another study revealed that gender imbalance has decreased in the last two decades among the most cited communication scholars' proportion, almost three-quarters (74.3%) of them are still (white) men (Freelon et al., 2023). Although the above research explored how the Matilda effect prevails in gender ratios in authorship and among leading scholars in the prominent segments of communication studies, we still do not have information on possible gender proportions among the most cited authors in Google Scholar. Therefore, we formulate the following research question:

RQ1) Are there equal gender proportions in Google Scholar among the most cited scholars in (a) Political Communication, (b) Journalism, (c) Health Communication, (d) Media Psychology, and (e) the pooled sample?

Ample evidence suggests that a gendered citation gap persists in sciences and male scholars receive more citations than their female peers (Dion et al., 2018). Again, what might cause the Matilda effect in receiving citations? Dion and colleagues (2018) consider two important factors: productivity gaps and differences in self-citations. First, males tend to be more prolific than women because they occupy higher positions, work in larger research networks, win more funds, have smaller dropout rates during their careers, spending less time on caregiving, and possibly have less or no career breaks while they work in academia (Huang et al., 2020). Second, men are willing to cite their own papers more frequently than women, which is theoretically labelled as gender homophily in citations (Hutson, 2006; Maliniak et al., 2013; Potthoff & Zimmermann, 2017; Zigerell, 2015).

Nevertheless, regarding gender bias in citations, Dion and colleagues emphasize that it is "difficult to know if this occurs simply because men publish and cite themselves more than women or if scholars systematically fail to cite relevant work by women in their field (or both)" (2018, p. 315). What is more important, however, is that the Matilda effect in citations is detrimental because it disregards many women's works and findings that should be introduced in papers, monographs, book chapters, textbooks, and courses at academic institutions (Colgan, 2017; Hardt et al., 2017). If many female scholars' findings are marginalized, a large part of the scientific work might fade away, and inequalities will be maintained in academia, where diverse knowledge production should be essential, if not paramount.

Several studies have analyzed the possible gender gaps within the citation patterns of published papers to investigate the prevalence of the Matilda effect, but their outcomes are contradictory. On the one hand, the Matilda effect emerges in the research fields of

Ecology (Cameron et al., 2016), Economics (Ferber, 1988; Ferber & Brün, 2011), Library and Information Sciences (Håkanson, 2005), Mathematics (Aksnes et al., 2011), and Political Science (Maliniak et al., 2013). On the other hand, there was no Matilda effect in citations in Biochemistry (Long, 1992), Construction Studies (Powell et al., 2009), Criminal Justice (Stack, 2002), Economic History (Di Vaio et al., 2012), Geography (Slyder et al., 2011), International Relations (Østby et al., 2013), Public Administration (Corley & Sabharwal, 2010), and Sociology (Ward, 1992).

In communication research, important analyses considering citations were conducted on gender gaps. In line with the role congruity theory (Eagly & Karau, 2002), scholars found that male researchers are cited more than females in *Communication Research* and the *Journal of Communication* (Knobloch-Westerwick & Glynn, 2013). Another study found that male scholars cite their male peers more often than they cite female researchers, and vice versa, thus proving gender homophily in citations in two leading German communication studies journals (Potthoff & Zimmermann, 2017). This gender homophily in citations is partly due to differences in male and female communication scholars' research interests (Potthoff & Zimmermann, 2017). Based on the results of the structural equation modeling in the aforementioned study, male authors tend to be cited more than female authors. This conclusion was drawn from the model which demonstrated that the gender composition of authors (higher values indicating higher impact of male authors) and "masculine" / "feminine" research subjects affect the proportion of female authors cited. The gender composition of authors had a negative effect on the choice of female-typed research subjects, and a positive effect on male-typed research subjects, which in turn affects the proportion of female authors cited (Potthoff & Zimmermann, 2017). Recent research also highlighted that even though female communication scholars' publications are viewed more than the work of their male colleagues, women's papers are cited less than male authors' publications (Author, 2022b). In contrast, Feeley and Yang (2022) analyzed the number of (self-) citations in eight communication journals and found that the Matilda effect emerged "only" in *Health Communication* and *Political Communication* and that the effect was minor. However, they also argue that males were more likely to self-cite their own papers in six journals than females. Against this backdrop, we outline the following research question:

RQ2) How does gender affect citation counts in a) Political Communication, b) Journalism, c) Health Communication, d) Media Psychology, and e) the pooled sample?

Method

Google Scholar is a growing platform that measures researchers' publications and citation counts across years (Marsicano et al., 2022). Its use has grown in recent years, even in research evaluation processes (Hayashi, 2019). The platform allows users to summarize their research production by linking each research item to a given citation score provided by Google Scholar's search algorithm. The platform also allows users to outline their individual research fields via research labels and ranks the most cited scholars according to their citation scores. Although research output and citation counts might be occasionally misreported by Google Scholar or researchers, it is a platform that can be used to assess impact and productivity in several evaluation processes.

Data for this study was directly computed from Google Scholar. To gather individual level data from the four subfields, the top 100 hundred most cited scholars were examined by selecting each discipline in Google Scholar (n = 400). We coded all data for every scholar across subfields on the same day (22/06/2022) to avoid discrepancies in citation counts and research output, as highly cited scholars may increase bibliometrics from one day to another. We rely on citation counts, productivity, and years of experience (measured as the total number of years since the first citation) as reported directly in Google Scholar. If coders detected inconsistencies at individual level data, records were manually corrected: false positives (i.e., fake or irrelevant profiles) were removed from the dataset, introducing the subsequent profiles within the subfield list. In such cases, scholars' production was manually reviewed to detect mismatches between research interest and research output (for instance, scholars interested in Journalism and publishing in Aeronautics).

However, in most cases, the most cited scholars in the four subfields under scrutiny had accurate profiles, thus such corrections were minimal. For the pooled sample, subfields were merged and duplicates were removed (i.e., scholars cross-listed in two or more subfields, n = 25). Regarding intercoder agreement, the first author independently coded a random selection of 20% of observations the same day of the original data collection and disagreements were not found (100% agreement for gender, 100% for citation counts, 100% for research output, and 100% for year since first citation). The variables of interest are explained below.

Dependent and Independent Variables

Subfields. This variable taps on four subfields plus the pooled sample (collapsing the four subfields into one value): Political Communication, Journalism, Health Communication, and Media Psychology. We chose the categories included in this study based on the size, thematic patterns, influence, and diversity of the given subfield within communication studies. Furthermore, the chosen subfields are also represented in ICA divisions, indicating their relevance and magnitude within the wider field.

Gender. This variable deals with the gender of the author under review. We consider the typical divide in scientometric analysis (male vs. female) by manually checking the name reported in Google Scholar and the personal photograph. In case of uncertainty, coders made Google searches to clarify the gender of the scholar. This variable is considered the main independent variable in the regression models (males = 269; females = 106).

Citation count. Total number of citations that were reported at each individual profile of Google Scholar. This variable is the dependent variable in the regression models. Pooled sample (range = 63,198; mean = 8085; SD = 8249.32; skewness = 2.92, SD = 0.12; Kurtosis = 11.79, SD = 0.24), political communication (range = 42.269; mean = 10,269.20; SD = 8042.19; skewness = 2.47, SD = 0.24; Kurtosis = 7.06, SD = 0.47), journalism (range = 44,652; mean = 7709.18; SD = 6841.63; skewness = 2.92, SD = 0.24; Kurtosis = 11.54, SD = 0.47), media psychology (range = 57,826; mean = 4736.24; SD = 7811.64; skewness = 4.43, SD = 0.24; Kurtosis = 24.43, SD = 0.47), health communication (range = 60,985; mean = 9627.65; SD = 9114.18; skewness = 3, SD = 0.24; Kurtosis = 12.72, SD = 0.47).

Controls

As citation counts may be affected by both the levels of productivity and years of experience in academia (Li et al., 2017), our regression models controlled for both. Research suggests that levels of research productivity significantly and positively boost citation records (Li et al.,

Table 1 Gender proportions among the most cited scholars in Google Scholar across four subfields of communication

Subfield	Male	Female	Equal Prop	Adj. Residuals	$\chi^2(df)$
Political Communication	85	15	50	– 35	49.00(1)***
Journalism	79	21	50	– 29	33.64(1)***
Health Communication	59	41	50	– 9	3.34(1)***
Media Psychology	67	33	50	– 17	11.56(1)***
Pooled sample	269	106	187.5	– 81.5	70.85(1)***

*p < .05; **p .01; ***p < .001

2017). Therefore, scholarly overproduction is likely to increase impact and visibility (Li et al., 2017). Likewise, scholars' total citation records are significantly influenced by the years of experience since the first citation: the more years a researcher spends publishing, the better chance they have at accumulating high citation statistics.

Research output. This variable considers different types of research, such as papers, books, book chapters, conference proceedings, editorials, and all potential material subject to being cited by the scientific community and that has been manually or algorithmically uploaded by researchers or Google Scholar to the individual profiles. Pooled sample (range = 1116; mean = 151.01; SD = 116.03; skewness = 2.50, SD = 0.12; Kurtosis = 13.02, SD = 0.24), political communication (range = 512; mean = 156.17; SD = 93.03; skewness = 1.31, SD = 0.24; Kurtosis = 2.41, SD = 0.47), journalism (range = 625; mean = 163.95; SD = 108.82; skewness = 1.74, SD = 0.24; Kurtosis = 4.05, SD = 0.47), media psychology (range = 519; mean = 101.52; SD = 92.70; skewness = 2.04, SD = 0.24; Kurtosis = 4.56, SD = 0.47), health communication (range = 1092; mean = 182.42; SD = 146.65; skewness = 3.11, SD = 0.24; Kurtosis = 16.16, SD = 0.47).

Years since first citation. We compute the years since first citation by counting the number of years in a scholar's Google Scholar profile (min = 5; max = 40; mean = 20.51; SD = 7.47).

Analysis strategy

In order to answer the research questions, we relied on two different statistical tests. First, to answer RQ1, we ran a series of χ^2 Goodness of Fit test, one for each subfield of study and one for the pooled sample, by collapsing all subfields. The minimum expected frequency for running this statistic was met. Second, to answer RQ2, we ran a series of bootstrap OLS-regression models. As assessed by a visual inspection of distributions, citation counts across subfields were not distributed normally. Accordingly, in order to provide reliable findings, the study ran a series of bootstrap OLS-regression models accounting for robust standard errors based on bootstrapping to 1,000 resamples with biased corrected confidence to assess statistical significance.

Table 2 Gender bias in citation scores among the most cited scholars in Political Communication

	β	SD	Lower Bound CI	Upper Bound CI
Block 1: Controls				
Productivity	0.51***	8.72	25.64	59.69
Years since first citation	0.06	118.85	−136.50	344.53
ΔR^2 (%)	31.6			
Block 2: Variable of Interest				
$\text{Gender}_{(\text{female})}$	−0.09*	915.88	−3,845.24	−153.87
ΔR^2 (%)	0.7			
Total ΔR2 (%)	32.3			

Sample size = 100. Cell entries are final-entry standardized Beta (β) coefficients. Coefficients effects accounted for robust standard errors test based on bootstrapping to 1000 resamples with biased corrected confidence to assess statistical significance

*p < .05; **p .01; ***p < .001

Table 3 Gender bias in citation scores among the most cited scholars in Journalism

	β	SD	Lower Bound CI	Upper Bound CI
Block 1: Controls				
Productivity	0.34*	8.10	7.08	40.24
Years since first citation	0.11	92.53	−68.11	286.39
ΔR^2 (%)	17.9			
Block 2: Variable of Interest				
$\text{Gender}_{(\text{female})}$	−0.17*	952.89	−4,723.62	−1,055.78
ΔR^2 (%)	2.6			
Total ΔR2 (%)	20.5			

Sample size = 100. Cell entries are final-entry standardized Beta (β) coefficients. Coefficient effects accounted for robust standard errors test based on bootstrapping to 1,000 resamples with biased corrected confidence to assess statistical significance

*p < .05; **p .01; ***p < .001

Results

The first research question inquiries about the gender representation among the most cited Google Scholar researchers across different subfields of communication (see Table 1). The χ^2 Goodness of Fit test showed that there were statistically significant differences between the number of male and female scholars across every subfield and in the pooled sample. In other words, assuming equal proportions, there is a prominent male majority in the category of the most cited researchers. At the subfield level, the starkest underrepresentation is in Political Communication, with female scholars accounting for only 15% of the sample, followed by Journalism (21%), Media Psychology (33%), and Health Communication (41%). In the pooled sample, the situation is also quite unbalanced as females make up 28.26% of the most cited category.

A series of OLS-regressions were run to answer RQ2 for each subfield of study and the pooled sample. In Political Communication (see Table 2), after controlling for productivity

Table 4 Gender bias in citation scores among the most cited scholars in Health Communication

	β	SD	Lower Bound CI	Upper Bound CI
Block 1: Controls				
Productivity	0.50**	6.97	22.77	49.74
Years since first citation	0.18*	97.95	48.48	409.87
ΔR^2 (%)	32.8			
Block 2: Variable of Interest				
$Gender_{(female)}$	−0.10	1,477.45	−5,074.75	979.57
ΔR^2 (%)	1			
TOTAL ΔR2 (%)	33.8			

Sample size = 100. Cell entries are final-entry standardized Beta (β) coefficients. Coefficient effects accounted for robust standard errors test based on bootstrapping to 1000 resamples with biased corrected confidence to assess statistical significance

*p < .05; **p .01; ***p < .001

Table 5 Gender bias in citation scores among the most cited scholars in Media Psychology

	β	SD	Lower Bound CI	Upper Bound CI
Block 1: Controls				
Productivity	0.54**	10.44	27.74	65.18
Years since first citation	0.27	172.98	66.30	681.04
ΔR^2 (%)	48.5			
Block 2: Variable of Interest				
$Gender_{(female)}$	−0.05	935.82	−3,123.86	942.50
ΔR^2 (%)	0.2			
TOTAL ΔR2 (%)	48.7			

Sample size = 100. Cell entries are final-entry standardized Beta (β) coefficients. Coefficient effects accounted for robust standard errors test based on bootstrapping to 1000 resamples with biased corrected confidence to assess statistical significance

*p < .05; **p .01; ***p < .001

($\beta = 0.51$; $p < 0.001$) and years since first citation, female scholars are significantly less cited than their male peers ($\beta = -0.09$; $p < 0.05$).

Similarly, in Journalism (see Table 3) results of the regression analysis revealed that after controlling for productivity ($\beta = 0.34$; $p < 0.05$) and years since first citation, female scholars are significantly less cited than their male peers ($\beta = -0.17$; $p < 0.05$).

However, in Health Communication (see Table 4), the most balanced subfield in terms of gender representation among the most cited scholars (see RQ1 above), after controlling for productivity ($\beta = 0.50$; $p < 0.01$) and years since first citation ($\beta = 0.18$; $p < 0.05$), we found no statistically significant differences between male and female scholars' citation scores.

In Media Psychology (see Table 5), the second most balanced subfield in terms of gender representation among the most cited scholars, after controlling for productivity ($\beta = 0.54$; $p < 0.01$) and years since first citation, we found no statistically significant differences between male and female scholars' citation scores.

Table 6 Gender bias in citation scores among the most cited scholars in the pooled sample

	β	SD	Lower Bound CI	Upper Bound CI
Block 1: Controls				
Productivity	0.48***	4.24	27.40	44.46
Years since first citation	0.19**	56.43	103.68	317.39
ΔR^2 (%)	34			
Block 2: Variable of Interest				
$\text{Gender}_{(\text{female})}$	− 0.10**	558.36	− 3,034.06	− 737,27
ΔR^2 (%)	1			
Total ΔR2 (%)	35			

Sample size = 375. Cell entries are final-entry standardized Beta (β) coefficients. Coefficient effects accounted for robust standard errors test based on bootstrapping to 1000 resamples with biased corrected confidence to assess statistical significance

*p < .05; **p .01; ***p < .001

Finally, collapsing all subfields in the pooled sample (see Table 6), the regression analysis revealed that after controlling for productivity (β = 0.48; p < 0.001) and years since first citation (β = 0.19; p < 0.01), female scholars are significantly less cited than their male peers (β = -0.10; p < 0.05).

Discussion and conclusion

Extant research has investigated the Matilda effect in sciences, indicating significant gender biases in productivity, performance, and career paths (Dion et al., 2018; Huang et al., 2020). In the field of communication, studies explored gender-based citation disparities (Feeley & Yang, 2022; Freelon et al., 2023; Knobloch-Westerwick & Glynn, 2013; Knobloch-Westerwick et al., 2013). Although the overall inequalities are apparent, subfield-level analyses are still scarce, prompting a need for a deeper, high-resolution exploration. Therefore, we examined the gender proportions among the most cited scholars in Political Communication, Journalism, Health Communication, and Media Psychology, as well as the gender-based citation counts between them. Given the absence of prior analyses on the Matilda effect within Google Scholar (i.e., recent similar analysis by Freelon et al. (2023) apply WoS and Scopus data), we provide novel insights into the representation and citation patterns of top-cited researchers.

With regards to our first research questions, we found that, compared to their male peers, highly cited female authors are underrepresented in all subfields and in the pooled sample, regardless of whether the field is one traditionally considered masculine or feminine. These striking results are aligned with previous findings indicating a lack of balanced female representation among the top performing communication scholars (Freelon et al., 2023; Knobloch-Westerwick & Glynn, 2013). Importantly, disparities are substantial in the pooled sample, Political Communication, Journalism, and Media Psychology. While the overall picture in Health Communication is more gender balanced, it is still significantly skewed in favor of men.

The struggle to dominate academic knowledge production and impact in social sciences, including communication studies, is obvious. Although many researchers have focused on regional and economic aspects, suggesting that rich Western institutions dominate the poor, non-Western academia in publications and citations, gender is another structure that must be considered in academic inequalities (de Sousa Santos, 2018; Rossiter, 1993; Wallerstein, 1999). Gender bias in social sciences is interesting in particular because it also emerges *within* core institutions and not only in academia embedded in the periphery (Author, 2020). But how should this specific type of inequality be understood in this case? The role congruity theory supports the interpretation of why there was a significantly lower female presence among the top-cited communication researchers on Google Scholar (Eagly & Karau, 2002; Garcia-Retamero & López-Zafra, 2006; Knobloch-Westerwick & Glynn, 2013). Agentic features characterize the role of scientists, who are considered to be ambitious and career-oriented (Knobloch-Westerwick et al., 2013). These characteristics are aligned with male social roles rather than female roles, which are assumed to be community-oriented instead (Eagly, 1987).

To acquire citations, scholars must publish papers in highly prestigious journals, participate in large and prolific research networks, win grants, hold high academic positions, win scholarly awards and promotions, spend much time with research, attend international conferences, and share their publications via (academic) social sites (Demeter, 2020). The above factors are closer to the career-oriented, agentic roles rather than the “caring” communal ones. On top of that, these efforts require time. Time is crucial because earlier studies have observed that there is a higher proportion of female than male scholars at the lower rungs of academia level, indicating that women typically teach more than men, and thus have less time to participate in research and publish outstanding papers in prestigious journals (Author, 2020).

Additionally, the Matilda effect was outlined in 1993, and the empirical analysis of this research tradition harks back only a few decades. We take this into account because many scholars among the top-cited communication researchers published before the 1990s, when less attention was paid to citing females and males equally. Even though the Matilda effect theory is three decades old, it still needs time to gain prominence in scholarly analysis. Thus, studies with results similar to ours can highlight the importance of acknowledging – via citation records – women’s academic publications more frequently (Freelon et al., 2023).

Taking a closer look at our results on female underrepresentation among the top-cited scholars, we can interpret them from another angle. Our findings indicated that Political Communication and Journalism studies, which are typically portrayed as masculine research fields (Knobloch-Westerwick & Glynn, 2013), show the most serious female underrepresentation (15% and 21%) among the most cited scholars. In turn, Health Communication—that is, the field most connected to the notion of “care”—was the most balanced (41%). Prior studies (Holman et al., 2018; Larivière et al., 2013) have indicated a stronger male dominance in fields connected to policy making and social power, while politically less involved fields generally associated with “care,” tend to be more balanced. This explanation can be a relevant one if we try to understand the gender bias, which seems to be *stratified* among communication scholars on Google Scholar. In other words, even though each subfield analyzed is significantly male-dominated in terms of presence, the difference is smaller in Health Communication, possibly due to its proximity to the female social role that implies care (Knobloch-Westerwick & Glynn, 2013).

Notwithstanding, although most scientific fields are becoming more gender balanced over time (Elsevier, 2017), citation biases—as citations are accumulated over a relatively long time—still prevail. Consequently, in our second research question, we measured gender-based citations, controlling for academic experience (i.e., the years since their first citation) and productivity. After controlling for these measures, our study revealed female scholars to be significantly under-cited in the pooled sample as well as in the subfields of Political Communication and Journalism. Notwithstanding, in the case of Health Communication and Media Psychology, we found no significant differences in gender-based citations. That is, while in Health Communication and Media Psychology, the general under-recognition of female scholars can be attributed to the aforementioned slow process of adaptation of citation measures to progress in gender equality, the same cannot be stated for Political Communication and Journalism, emphasizing currently existing socio-cultural citation biases towards female scholars.

Our analysis also indicated that fields with similar proportions of females and males among the most cited scholars are also those in which gender differences in citation counts seem to disappear. Specifically, the regression analysis revealed significant differences in citation counts in Political Communication, Journalism, and the pooled sample. On the other hand, the more diverse fields of Health Communication and Media Psychology showed no significant biases concerning research impact based on gender after controlling for productivity and academic experience.

The outcomes on the gender differences in receiving citations outline the following conclusions. Even though many female scholars acquired positions among the top-cited communication researchers, the scientific community acknowledges their work equally if their research field is considered to be aligned with their "expected," communal social characteristics. Media Psychology and Health Communication are closer to the communal roles than the other two subfields (Knobloch-Westerwick & Glynn, 2013). In other words, the underlying communal characteristics in Health Communication and Media Psychology "allow" female researchers to acquire unbiased level of recognition *if* they are first able to make their way into the elite league of the most cited scholars. Put differently, *agentic* characteristics are sufficient to be among the most recognized scholars but, for women, their subfield should contain *communal* social characteristics for them to acquire the same level of recognition as males in Health Communication and Media Psychology. In turn, "masculine" fields such as Political Communication and Media Psychology seem to resist females' equal recognition because (1) the effort to get into the elite league of the most cited scholars needs agentic characteristics and (2) these subfields are "masculine" as they deal with power and influence on larger communities. As a result, the presence of the two, intertwined structural factors attached to Political Communication and Journalism are too strong to let female scholars receive the same recognition as males. Nevertheless, we contend that these subfields ought to adopt a more inclusive stance towards women, acknowledging and valuing their scientific contributions to prevent overlooking their impact. Fostering a mindful approach to citations is essential for advancing towards a more diverse and inclusive body of scientific knowledge.

Limitations and future research

As mentioned above, Google Scholar indexes grey literature that may inflate citation counts. Consequently, our results should be interpreted with caution, especially if compared with certain other databases such as Web of Sciences or Scopus. In addition, due to the unsupervised crawling methods of Google Scholar, fake profiles, fake papers or non-curated material can introduce important bias in measuring citations counts. Our analysis, fully aware of these potential biases of Google Scholar, tried to reduce the measurement error by consciously implementing a content analysis, and collecting data for all subfields and academics on the same day to prevent variations in their citations or production records. As a consequence of these limitations, we measured four diverse subfields within communication, yet future studies may also consider extending this analysis to other subfields of communication or other fields of sciences.

We also need to note that examining the top-cited scholars has limitations. Firstly, it concentrates on a narrow group of scholars, offering a limited perspective on general patterns of the fields under examination. Secondly, biases related to factors like gender and institutional affiliations may distort the analysis within this subset (Kwiek, 2018). To address these challenges, future research should broaden its focus to a more representative sample, ensuring a broader understanding of gender representation and research impact.

It is also important to note that there are certain limitations to the gender-based categorization of communication scientific subfields. As Knobloch-Westerwick and Glynn (2013, pp. 12–13) pointed out: "Regarding gender-typed topics, 48 pieces (4.7%) fell into the "female-typed" category, 236 (23.1%) fell into the "male-typed" category, and 17 pieces (1.7%) were categorized to fall into both categories based on featuring strings associated with stereotypes for both genders. The vast majority of 711 (70.5%) emerged as "gender-neutral" based on the categorizations of gender-typed research topics". Therefore, it is highly important to exercise caution when categorizing communication research topics based on gender stereotypes, as well as to avoid distinct dichotomous categories.

Funding Open access funding provided by National University of Public Service.

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