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*The Gender Citation Gap in Undergraduate Student Research:
Evidence from the Political Science Classroom*

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ABSTRACT: Previous studies have documented a “gender citation gap” in political science, whereby women are less likely to be cited in published research and course syllabi, especially by male scholars. However, no previous study has examined citation patterns among students in political science courses to determine if similar patterns are evident in their research. This article analyzes an original database of individual, as well as group, research assignments from an undergraduate research methods course. Our analysis indicates that male students are significantly less likely than female students to cite research published by women – whether as first authors, any of the authors, or the average percentage of authors per team. However, in a subsequent group research assignment, gender diversity had no discernible effect on group citation patterns. We discuss the implications of these findings for current pedagogical practices and the future state of the discipline.

KEYWORDS: Gender; Citation Gap; Undergraduate Students

PULL QUOTES:

- We use original data from an introductory political science research methods course to examine the relationship between student gender and gendered citation patterns.
- To evaluate gender bias in student citations, at the individual and group levels, respectively, we propose the following hypotheses: first, male students are less likely than female students to cite research authored by women (hypothesis 1); second, groups with fewer female students are less likely to cite research authored by women (hypothesis 2).
- Our results indicate that gender bias *does* influence undergraduate students’ citation patterns—but only at the individual level.

Previous studies point to a “gender citation gap” in the field of political science, broadly speaking, whereby female authors are disproportionately less likely to have their work cited than male authors. Specifically, when publishing original research, political scientists are less likely to cite studies conducted by women than men (Dion, Sumner, and Mitchell 2018; Maliniak, Powers, and Walter 2013; Mitchell, Lange, and Brun 2013; Peterson 2018; but see Esarey and Bryant 2018).¹ Also, political science instructors are less likely to cite women than men in their course syllabi and they tend to assign textbooks and other readings in which women are underrepresented (Colgan 2017; Diament, Howat, and Lacombe 2018; Phull, Cifliki, and Meibauer 2018).²

However, these studies examine the gender citation gap among political science *scholars*, only. No previous study has examined whether, and to what extent, this gap exists among political science *students*, also.³ We present such an analysis in this article, with a focus on undergraduate student research. Specifically, we use original data from an introductory political science research methods course to examine the relationship between student gender and gendered citation patterns. Our data come from two stages of an original research project, completed by students over the course of one semester. Students completed the first stage of this research individually and the second stage in groups, thereby enabling us to analyze citation patterns as a function of an individual student’s gender as well as group gender dynamics.

It is important to study the gender citation gap among political science students – and not solely among scholars – for three reasons. First, gender bias is unacceptable as a matter of equity and it undermines students’ educational experience in political science. For example, the gender citation gap may be indicative of broader gender biases that negatively affect a classroom learning environment, and as such, cannot be tolerated or ignored. Also, discounting research

conducted by women necessarily limits a student's understanding of political science research, as a whole, which in turn should compromise the quality of his or her performance on research projects and overall educational experience. Thus, as a basic pedagogical matter, it is essential for political science instructors to understand how gender bias *in any form* – including the gender citation gap – manifests itself in the classroom and negatively impacts students.

Second, studying the gender citation gap in undergraduate student research would make a valuable contribution to combating implicit gender bias in the political science classroom. Indeed, this study can provide evidence that might help convince skeptical students (as well as some faculty) that such problems likely exist and ought to be addressed. Also, it could provide the impetus for political science instructors and departments to explore strategies aimed at doing so. For example, instructors might use this study or similar ones to engage students in discussions of the gender citation gap prior to conducting political science research, whether in a traditional classroom setting or for an independent study or honors thesis. Instructors might even design experiments to test which type of intervention is most effective at reducing the gender citation gap among students, such as assigning a reading on the topic versus requiring students to analyze their own citation patterns from previous assignments.

Third, this research provides essential context for previous studies of the gender citation gap. Those studies, cited above, demonstrate that political scientists generally engage in gendered citation patterns, which, among other things, may skew political science students' perceptions of what qualifies as the most relevant scholarship in the field. Indeed, scholars' citation patterns alone may be enough to have an effect. But students are not blank slates. To the extent that students enter the classroom already inclined to discount women's research, political scientists' gendered citation patterns actually may be exacerbating an existing bias among

students of which we are not yet aware. If so, then the gender citation gap among scholars may be even more problematic than previous studies indicate. Of course, our study is not designed to test for an interactive effect of students' and scholars' gendered citation patterns. However, this work can serve as a necessary first step toward researching such effects in the future.

Data & Methods

The objective of this study is to determine whether—and, if so, to what extent—gender bias influences students' citation patterns, specifically when it comes to citing women. Such biases may be evident in research conducted by individual students, by groups of students, or both. In other words, gender bias may influence how students conduct their own research and/or how students collaborate with others when conducting research. Either phenomenon may limit students' exposure to female-authored research and perpetuate the gender citation gap.

To evaluate gender bias in student citations, at the individual and group levels, respectively, we propose the following hypotheses: first, male students are less likely than female students to cite research authored by women (hypothesis 1); second, groups with fewer female students are less likely to cite research authored by women (hypothesis 2). Both hypotheses are consistent with previous findings regarding gendered citation patterns among scholars (Dion et al. 2018; Mitchell et al. 2013).

Data for this analysis come from an original database of research projects completed as part of an undergraduate political science research methods course at a private, Midwestern university. Our sample includes all 140 students (65 women, 75 men) enrolled in one of seven course sections offered between Spring 2017 and Spring 2019. Each course section was taught individually by two of this article's co-authors (one woman, one man).⁴

Over the course of one semester, students followed a scaffolded approach to complete an original research project. The first stage of this project was an annotated bibliography that each student completed individually. The final stage of this project was a ten-page research paper comprised of a literature review, research design, and data analysis, all of which were completed in groups of three to four students.⁵ We use two research assignments integral to students' development of the final project—the annotated bibliography and the literature review—as our data sources. For the annotated bibliography, each student located and summarized four to five peer-reviewed articles directly addressing a research question developed by the group to which he or she was assigned at the beginning of the semester. After completing the annotated bibliography, students then worked with their fellow group members to write a literature review that would later be incorporated into their final research paper, citing 12 scholarly articles. Since most groups included four students, and most students cited at least four articles in their annotated bibliographies, each group had to decide which articles to eliminate or retain for the literature review. Also, they could add new articles, which many groups did in response to the instructor's feedback.⁶ In total, the (individual) annotated bibliographies included 624 citations, and the (group) literature reviews included 483 citations.

To test our hypotheses, we began by coding each author's gender—or, at least, students' likely perception thereof. Two graduate students (one woman, one man) coded each author by name, exactly as it appeared in the student's or group's citation, as: certainly a man/woman (90-100% confidence); probably a man/woman (60-90% confidence); or indeterminable (less than 60% confidence).⁷ For this analysis, we combined the certain and probable gender identifications so that each author is coded as a woman, a man, or indeterminable.⁸ Next, we generated three measures of gendered citation patterns:⁹ first, the percentage of articles cited by a student or

group in which the *first author* was a woman; second, the percentage of articles in which *any author* was a woman; third, the *average percentage* of authors who were women, per article.¹⁰

Results

Figure 1 provides an initial indication of gender's influence on student citation patterns. Here, we see the percentage of articles that male versus female students cited in their annotated bibliographies, in which the first author or any author was a woman, as well as the average percentage of female authors per article. Figure 1 also includes 95% confidence intervals to indicate whether these percentages differ significantly based on student gender. All three measures exhibit such differences. Specifically, we see a 14 percentage-point gender gap with respect to first authorship; a 16 percentage-point gap with respect to any inclusion of women; and an 11 percentage-point gap with respect to the average share of female authors per article. In each case, male students were less likely than female students to cite research conducted by women.

But there is good reason to believe that other factors might confound, or at least weaken, the bivariate relationships from Figure 1. First, some students' research interests pertain to political science subfields where women are more active and publish more frequently than other subfields. If female students, in particular, gravitate toward studying topics within these subfields, then that may help explain the gender disparities we see in Figure 1. Second, the college experience should increase students' awareness of gender and other inequities, such that more advanced students may be more sensitive and responsive to concerns about diversity and inclusion. We might expect, then, a fourth-year student's citation pattern to be more gender-inclusive than that of a second-year student.

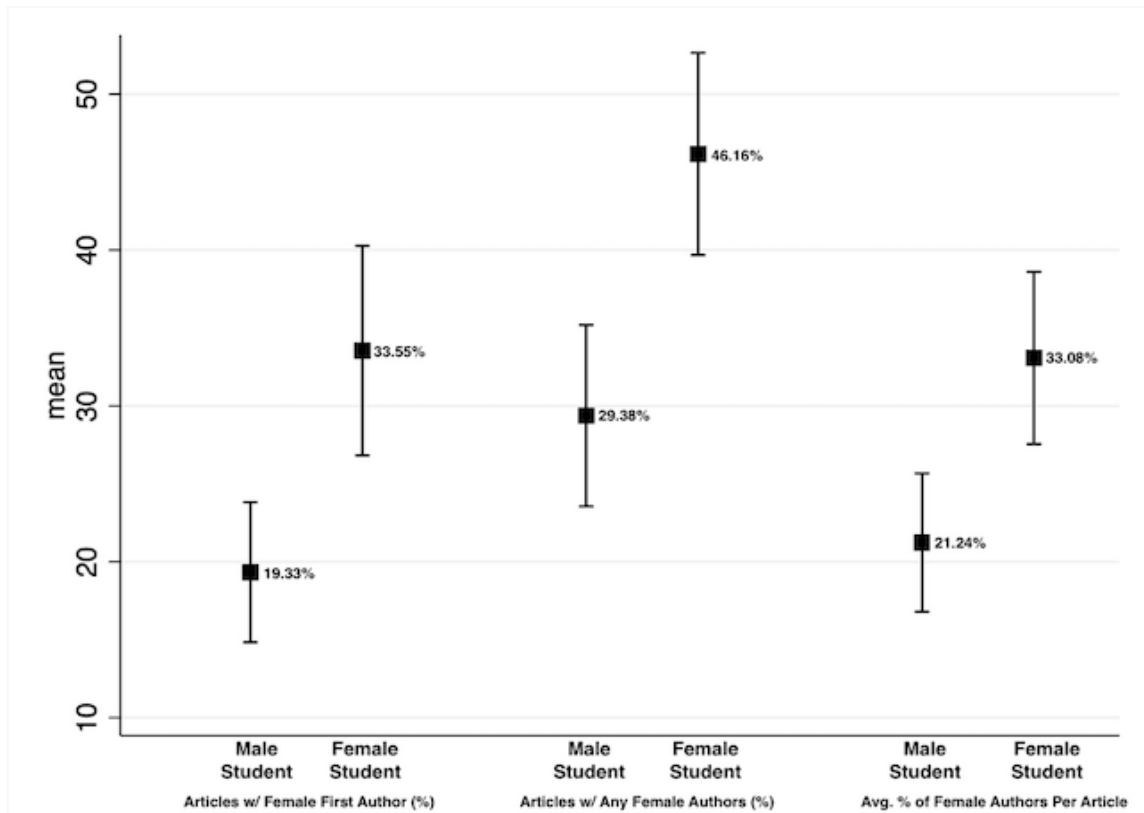


Figure 1: Citation of Women’s Research in Male vs. Female Students’ Annotated Bibliographies

To account for potential confounders, we estimate three linear regression models. The dependent variables are the same as in Figure 1. The independent variable is student gender (0=male, 1=female). Also, we include two control variables. First, to account for women’s subfield presence, we identify the American Political Science Association (APSA) organized section most closely related to the student’s research topic. Having done so, we record the percentage of women belonging to that organized section, as of early 2019.¹¹ For example, a student whose research most directly pertains to “Human Rights” (Section 36) would be coded as 54.8% on the subfield variable, since this is the percentage of section members identified as women. Second, we control for the student’s class year (1=first-year, through 4=fourth-year). Table 1 presents the results from our regression models.

Table A1. Citation of Women in Students' Annotated Bibliographies

| Parameter | Model 1 First author | Model 2 Any women | Model 3 Average % |
|---|---------------------------------|------------------------------|------------------------------|
| Student gender (0=male; 1 = female) | 8.942* (3.547) | 11.755* (3.838) | 6.517* (3.148) |
| Subfield (0=no women, to 100=all women) | 0.573 (0.328) | 0.513^ (0.293) | 0.544^ (0.270) |
| Class year (1=first year, to 4=fourth year) | -2.351 (2.297) | -4.165 (2.739) | -2.209 (2.087) |
| Professor Gender (0=male; 1=female) | 2.850 (7.743) | 7.740 (8.141) | .055 (6.592) |
| Constant | 5.904 (14.755) | 21.058 (13.780) | 7.569 (12.123) |
| N | 140 | 140 | 140 |
| R-squared | 0.170 | 0.190 | 0.178 |

Note: This table replicates Table 1, with the professor's gender added as a control variable.

Entries are logistic regression coefficients. Robust standard errors are in parentheses.

All observations are clustered by research group.

***p < 0.001; **p < 0.01; *p < 0.05; ^p < 0.10.

The dependent variables measure gender diversity in student citation patterns. First Author (Model 1) represents the percentage of citations with a woman as first author. Any Women (Model 2) represents the percentage of citations including any woman as an author. Average % (Model 3) represents the average percentage of authors who were women, per article.

The student gender variable is statistically significant, at $p < 0.05$, in each model, even after controlling for subfield and class year.¹² However, we do see smaller differences by student gender than in Figure 1. Here, the citation gap between female versus male students is 8.9 percentage points for first authorship; 11.5 percentage points for including any women; and 6.5 percentage points for the average share of female authors per article. Again, male students were less likely than female students to cite research conducted by women. This evidence clearly supports hypothesis 1.¹³

But does gender bias likewise affect how students conduct research in collaboration with other students? In other words, does gender diversity influence group citation patterns, with respect to gender—as seems to be the case for political scientists (Dion et al. 2018)? To answer this question, first we must modify our data so as to treat the group’s (literature review), rather than the student’s (annotated bibliography), submission as our unit of analysis. Our independent variable measures the percentage of women within a group (0=no women, to 100=all women), rather than an individual student’s gender.¹⁴ Also, we measure class year as the average for all group members. The subfield variable requires no modification, since its original measurement was based on the group’s research topic.

Finally, we calculate the dependent variables according to the difference between the percentage of women cited in the group’s literature review and the percentage of women cited in all of the individual group members’ annotated bibliographies, combined. For example, suppose that a group of four students submitted a literature review in which three of 12 articles (25.0%) had any female authors, whereas those students’ annotated bibliographies, combined, included six of 16 articles (37.5%) with any female authors. This group would be coded as -12.5% on the “any” dependent variable (37.5%-25.0%).¹⁵ In other words, its literature review is 12.5 percentage points less diverse, with respect to gender, than the original pool of citations.

To evaluate the relationship between the gender diversity of a student group and its citation patterns, we estimated three linear regression models. Table 2 presents the results from these models. In each case, we do not find evidence of any such relationship. That is, the percentage of women within a group has no discernible effect on how many women that group cited in its literature review, relative to the pool of citations with which it started.¹⁶ This evidence

does not support hypothesis 2. The gender bias that we observe so clearly in individual students' research apparently does not extend to the collaborative research setting.¹⁷

Table A2. Citation of Women in Group Literature Reviews

| Parameter | Model 1 First author | Model 2 Any women | Model 3 Average % |
|---|---------------------------------|------------------------------|------------------------------|
| Group gender (0=no women, to 100 = all women) | -0.004 (0.060) | 0.003 (0.061) | -0.029 (0.040) |
| Subfield (0=no women, to 100=all women) | -0.198 (0.149) | -0.215 (0.151) | -0.223* (.099) |
| Average class year (1=first year, to 4=fourth year) | 1.512 (3.426) | 2.079 (3.480) | 1.455 (2.271) |
| Professor Gender (0=male; 1=female) | -1.862 (4.676) | -1.639 (4.749) | 3.287 (3.099) |
| Constant | 5.756 (11.496) | 4.692 (11.677) | 5.795 (7.619) |
| N | 38 | 38 | 38 |
| Adjusted r-squared | 0.002 | 0.013 | 0.181 |

Note: This table replicates Table 2, with the professor's gender added as a control variable.

Entries are logistic regression coefficients. Standard errors are in parentheses.

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^ $p < 0.10$.

The dependent variables measure gender diversity in group citation patterns, relative to gender diversity in the group members' individual citation patterns. Specifically, in each case, we subtract the relevant measure, as applied to all group members' annotated bibliographies, combined, from that measure, as applied to the group's literature review. First Author (Model 1) represents the percentage of citations with a woman as first author. Any Women (Model 2) represents the percentage of citations including any woman as an author. Average % (Model 3) represents the average percentage of authors who were women, per article.

Conclusion

Overall, our results indicate that gender bias *does* influence undergraduate students' citation patterns—but only at the individual level. Male students *are* less likely than female students to cite research conducted by women. However, within groups, we find no evidence that

gender dynamics influence the collaborative process, such that male-dominated groups are more likely to exclude research conducted by women. The former result is consistent with previous evidence regarding political scientists' citation patterns (e.g., Mitchell et al. 2018), while the latter is not (Dion et al. 2018).

We can only speculate as to why our evidence does not support hypothesis 2. One possibility is that, whatever their private inclinations may be, students genuinely strive to include all members and their perspectives when participating in group work—and they succeed in doing so. Another possibility is that students simply were more intentional and more attentive to various details about a given article, including author gender, when conducting research individually, as compared to working in a group setting in which citation decisions might be deferred to other students. The latter explanation is quite plausible and could easily be tested using data from an alternative research assignment—for instance, one that requires the group to work together to locate articles for its literature review, rather than drawing upon a pool of citations from individuals' annotated bibliographies. Future research would be valuable in exploring such possible explanations, and in replicating our results across a diverse range of assignments and disciplines. Moreover, we recognize that this study is limited in terms of generalizability because our data come from seven sections of one course taught at one private, Midwestern university. Additional studies replicating or extending our research design in other courses and institutions would help to strengthen our understanding of undergraduate students' citation patterns and further address the gender citation gap in political science.

To the extent that women are, in fact, underrepresented in undergraduate student research, the question becomes: what do we, as a discipline, do about this? One practical response is for political scientists to evaluate whether they are setting a good example for their

students by measuring the citation gap in their own research and syllabi (see Sumner 2018) and making appropriate modifications. Another practical response is for instructors to explicitly address the gender citation gap with their students and encourage them to consider how gender biases might influence their work. Indeed, these are just the types of interventions that have been recommended to address the gender citation gap among political scientists (e.g., Brown and Samuels 2019; Peterson 2018). If similar biases are evident among students, surely this deserves our attention, as well.

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¹ However, these patterns seem to depend on author gender; women are more likely than men to cite other women's research, whether authored by one woman or an all-woman team. In that case, "most of the citation gap is driven by men and mixed author teams underciting the work of women rather than women overciting work by other female scholars" (Dion et al. 2018, 324). Women, too, are significantly less likely than men to cite their own work (Maliniak et al. 2013).

² Again, these patterns seem to vary by gender, with female instructors citing more female-authored research in their syllabi and senior male instructors assigning fewer articles by female authors (Colgan 2017; Phull et al. 2018).

³ In fact, the only previous studies of political science students' citation patterns focus on understanding how they find and evaluate sources (Datig 2016; Hendley 2012).

⁴ Among the students taught by the female professor (one section, 21 students), 47.6 % were female; among the students taught by the male professor (six sections, 119 students), 46.2 % were female.

⁵ There were 38 groups, in total, with 3.7 students per group, on average.

⁶ Instructor feedback was based on the quality of students' assignments and the applicability of the article selection to the research topic; no gender citation related information was given. Moreover, both instructors did not incorporate any intervention mechanisms for reducing the gender citation gap in their classrooms.

⁷ The latter category includes authors with gender-ambiguous names (e.g., Jamie); names that would be unfamiliar to most Americans (e.g., Xuesong); and those who were identified only by their initials (e.g., P.K.).

⁸ Intercoder agreement was very high, at 91.3%. In cases of disagreement, we made a final determination as to students' likely perception of the author's gender.

⁹ We use multiple dependent variables, in part, because previous studies of the gender citation gap yield different results depending on the number of authors included in the analysis (e.g., Dion et al. 2018; Esarey and Bryant 2018).

¹⁰ For example, suppose that a student cited four articles with the following number of female authors: 0/1, 0/2, 1/2, 3/3. The "average" percentage of female authors would be 37.5% $((0\% + 0\% + 50\% + 100\%)/4)$, and the percentage of "any" female authors would be 50% (two out of four articles).

¹¹ See here: <https://www.apsanet.org/RESOURCES/Data-on-the-Profession/Dashboard/Membership/Organized-Sections>. Accessed July 19, 2019.

¹² The subfield variable is significant at $p < 0.05$ in two models, and at $p < 0.10$ in one model, with the correct sign in each case. The class year variable is significant only at $p < 0.10$ in one model, but incorrectly signed.

¹³ Table A1 presents the same models, with the professor's gender added as a control variable. In each model, this variable is not statistically significant and the student gender variable remains significant. Also, the r-squared statistic increases slightly in Model 2.

¹⁴ The median group was 50% female. Seven groups included no women (18%) and five only women (13%).

¹⁵ A more obvious measurement strategy would be to calculate the percentage of women authors in the group's literature review without reference to the annotated bibliographies. But this would treat the former as if it were independent of the latter, which is quite wrong; in fact, most, if not all, of a group's literature review citations came from its members' annotated bibliographies. Given this interdependence, it is far more appropriate to evaluate the group's citation patterns in relation to the pool of citations with which it started.

¹⁶ One explanation for these null findings may be that our sample size ($n=38$) is too small to detect the hypothesized relationship. However, the subfield variable does attain conventional significance levels in one of the models. Also, if we exclude the subfield variable from the average difference model, the group gender variable becomes statistically significant at $p < 0.05$

(but incorrectly signed). In that case, it seems unlikely that our null findings can be attributed to a lack of statistical power.

¹⁷ Table A2 presents the same models, with the professor's gender added as a control variable. In each model, this variable is not statistically significant and the group gender variable is not significant. Also, the adjusted r-squared statistic increases slightly in Models 1 and 2.