The Role of Gender in Citation Practices of Learning Analytics Research

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ABSTRACT

Mounting evidence indicates that modern citation practices contribute to inequalities in who receives citations. In response to this evidence, our paper investigates citation practices in learning analytics (LA). We analyse citations in papers published over ten years at the Learning Analytics and Knowledge conference (LAK). Our analysis examines the gender composition of authored and cited papers in LA, estimating various factors that explain why one paper cites another, and if the citation rates differ across different author teams. Results indicate an overall increase in the number of women authors at LAK, while the ratio of men to women remains stable. Citation patterns in LAK are influenced by the seniority of authors, paper age, topic, and team size. We found that LAK papers with women as the last author are under-cited, but papers where the first author is a woman and the last author is a man are over-cited. Author teams with different gender composition also vary in who they over- and under-cite. Upon presenting the empirical results, the paper reflects on the role of mindful citation practices and reviews existing measures proposed to promote diversity in citations.

CCS CONCEPTS

• **Social and professional topics**;

KEYWORDS

learning analytics, citations, equity, gender

ACM Reference Format:
Oleksandra Poquet, Srecko Joksimovic, and Pernille Brams. 2024. The Role of Gender in Citation Practices of Learning Analytics Research . In *The 14th Learning Analytics and Knowledge Conference (LAK '24), March 18–22, 2024, Kyoto, Japan.* ACM, New York, NY, USA, 7 pages. https://doi.org/10.1145/3636555.3636878

1 WHY CITATION PRACTICES IN LEARNING ANALYTICS MATTER

Scientists conventionally cite sources when they present research findings. Although the reasons as to why a paper gets cited vary greatly [7], the overall function of citing in science is to persuade and strengthen the claims made by the authors. Citing shows that a study either builds upon or challenges known knowledge, convincing the reader of its foundation in accepted scientific ideas [17]. Therefore, it is only natural that in deciding *who* to cite the scientists select research that will be *both* relevant and effective in persuading the reader of its validity. Not surprisingly, the number of citations that a scientist received signaled their authority in the field. Merton detailed the social and reputational factors influencing a scientist's visibility [16]. These factors behind citations has since long been recognized as a part of academic capital, shaping academic power structures [21]. Although today's academia is no longer the world that Merton described, the social and reputation mechanisms remain similar [4, 13] .

Citations are an underlying backbone of scientific fields, indicating whose ideas get accepted as fundamental [14]. However, the number of citations is no longer merely a signal of one's reputation, now serving as an indicator that influences the rewards and resources allocated to scientists across many different levels [2]. Citations are used to rank universities. Citation-based metrics are used to evaluate if individuals get jobs, get promoted, or receive funding. Against this context, looking closely at citation practices becomes even more so important, given the relationship between individual choices the scientists make when they cite each other with the power, access to resources, and knowledge production practices that emerge from these choices.

There is mounting evidence showing that modern citation practices create inequalities in who is cited. Studies have found that scientists over-cite papers where the first and the last authors are men, whereas they under-cite papers where the first and the last authors are women [12, 20]. This over- and under-citation is estimated against the baseline that considers important factors that may impact citation choices such as types of submission or author seniority. Such patterns of inequality have been observed in neuroscience [5], medicine [3], communication [24], and physics [22], among other domains. Research has also shown that over-citation of men and the under-citation of women is driven by the citation practices of men [9, 22]. Moreover, a growing but less prominent body of work suggests that intersectional scientists are under-cited at even higher rates [1, 10]. Due to these alarming findings, both individual and policy-level measures have been suggested to address this issue [15].

In response to this growing evidence from other fields, this paper raises a question if citation practices in learning analytics (LA) are equitable. Admittedly, this is a sensitive question. None of us contributing to the LA scholarship would consider ourselves making biased choices when citing. Further, some of us may be strongly opposed to bringing the matters of advocacy into the way we go about scientific practices. Yet, this difficult question is an important one to raise. This question is powerful because in this instance

LAK '24, March 18–22, 2024, Kyoto, Japan

ACM ISBN 979-8-4007-1618-8/24/03…$15.00
https://doi.org/10.1145/3636555.3636878

every individual is capable of direct impact. Every scientist can control who she cites, no matter the seniority or the number of resources, and these decisions directly impact lives and careers of others. Therefore, evidence demonstrating the current status quo helps individuals re-evaluate and potentially revise their individual choices. Further, the question is timely. As Large Language Models are used for work with scientific literature, its impact on exacerbating existing biases in citation practices is highly likely. Hence, understanding the current state of citation practices prior to AI-adoption into our scientific practices is important. Taking a stock of where we are today can enable further evaluations of the effects of human-AI knowledge production. It is, therefore, both consequential and timely to reflect on the existing citation patterns in LA.

This paper analyses citations in Learning Analytics and Knowledge conference (LAK) proceedings (2011 - 2022). We combine descriptive and statistical approaches to report on the gender composition of authored and cited LAK papers (RQ1), as well as to understand what factors drive citation patterns (RQ2), and to what extent a gender bias may be present (RQ3). First, we briefly discuss research that analysed citation patterns, then we describe the dataset and its processing, and explain the methods. Finally, we present the results and reflect on the implications of our insights.

2 LITERATURE REVIEW

2.1 Evidence of Inequalities in Citation Practices

In recent years there has been a surge of re-evaluation of citation practices in several scientific fields. Evidence consistently points towards existing biases not related to the known factors influencing citation rates, such as type of paper, seniority of the author, or size of the author team. After accounting for non-gender factors that could affect citations, Dworkin et al. [5] found that in neuroscience, papers authored by first author woman and last author woman (WW) were cited 13.9% less, whereas papers where the first author and the last author were both men (MM) were cited 5,2% higher than expected from the hypothesis of no gender effect. In medicine, Chatterjee and Werner [3] found that papers where the first author was a woman were cited 33% less frequently that the articles where the first author was a man. In the field of communication, Wang et al. [24] found that papers where the first and the last authors were men were 13.8% over-cited, whereas those where the first authors were women were 20% under-cited, and that the over-citation of men and the under-citation of women is largely driven by the citation practices of men, consistent with other work that shows that men are less likely to cite female authors [9]. In physics, Teich et al. [22] observed similar patterns, with papers authored by women being significantly under-cited. They demonstrated that individual choices of scientists bring about cumulative effects that harm specific groups of scholars. Moreover, a growing but less prominent body of work shows that inter-sectional scientists are even more under-cited [1, 10].

2.2 Approaches to Analysing Citation Practices

Citation practices are analysed at the level of a paper. To quantify gender composition of research teams, Dworkin et al. [5] labelled each paper in relation to the gender of the first and the last author. In STEM, the first author is likely the lead author, whereas the last author is often a senior member of the author team. Using programmatic gender assignment, the papers were allocated a label of MM - first author man and last author man, MW - first author man and last author women, WM - first author woman and last author man, and WW - first author woman and last author woman. Using different approaches, they modelled expected citation rate, given the distribution of paper types by author, type of papers, year, seniority of authors, and compared it to the actual rate of how these papers have been cited, highlighting over- or under-citation patterns across different author populations. Several studies [6, 24] also quantified the effect of authorship networks on citations. Evidence suggested that although author social networks explain some of the over-/ under-citation, overall citation patterns remained.

2.3 Suggested Measures to Tackle Inequalities in Citation Practices

In response to the compelling evidence of inequality in citations, scientists have proposed ways to mitigate the situation. Llorenz et al. [15] reviewed individual and institutional activities to address gender inequality in authorship, peer review, citations, funding, and other processes. For a personal strategy, they suggested that individuals should review citation lists for bias before submission (*ibid.*, p.2051). For policy-level strategies, they suggested (1) "to increase diversity in review and editorial panels" - an approach that has been tested, recommended, and implemented; (2) "to automatically notify authors of an unbalanced citation list when they are submitting a manuscript to a journal', for 'editors to require written exception requests for sharply unbalanced citations", with both approaches implemented though not yet evaluated; (3) "to increase maximum allowable references", also already implemented by *Neuron, Frontiers, Brain, Human Brain Mapping, Plos One*), and (4) "to develop new citation metrics that account for gender balance and self-citation", a suggestion that has not been implemented and is debated (*ibid.*, p. 1051). Most of these strategies have been implemented and present examples that could be adopted in the LA scholarship.

Among interventions to improve individual citation practices is the so-called Citation Diversity Statement (CDS) [25]. CDS is "a paragraph placed before the reference section of a manuscript in which the authors address the diversity and equitability of their references in terms of gender, race, ethnicity, or other factors and affirm a commitment to promoting equity and diversity in sources and references."([19], p.5). In CDS individuals describe their reference lists in terms of the percentages of papers authored by teams of varying gender composition (MM, WM, MW, WW). Several biomedical top publishing venues now encourage the inclusion of CDS. Ray et al. [19] discussed the pros and cons of the CDS. It encourages individuals to reflect on the choices they make when they cite. Yet, open questions remain, such as what kind of diversity should be addressed and how to deal with the role versus perceived identity of an author. There is a worry that CDS may lead to potentially unethical practices, since citations should be conducted for scholarly purposes only. A common argument is that seminal and influential papers form the majority of what is cited, hence not much choice of what to cite exists. However, recent research shows that as much as 54% of citations have little to no influence on the global argument or design of the paper. This suggests that there is space for a reflective and ethical engagement with citation practices beyond the need for authoritarian citing [23].

3 RESEARCH QUESTIONS

The paper presents a case for a closer look at citation practices in LA, which we believe to be both powerful and timely. To support engaging with this issue, we posed the following research questions:

1 What is the gender composition of authorship of citing and cited papers in LAK papers published in 2011-2022?
2 What is the effect of factors, such as topic, type of paper, author seniority, year of publication, and team size on the probability of a LAK paper being cited?
3 Do LAK papers by authorship teams of different gender compositions get cited differently?

4 DATA

The dataset encompasses all LAK papers published between 2011 and 2022, along with their corresponding reference lists. Data are available at https://leapslab.github.io/la_citations. The analysis centers on LAK papers cited within these reference lists. Author names and reference information was pulled from various sources (published papers collected from SOLAR website, reference lists collected from PDF files as at the time of data collection only 50% of LAK papers were indexed by the *Scopus* database). Given the different sources, conventions for how authors were reported across files varied. This made it necessary to substantially pre-process and clean the data via a semi-automated pipeline, with programmatic and manual solutions. A significant portion of misspellings, missing values, and gender-determination-related errors in the raw data necessitated human judgment and manual correction, even after programmatic cleaning. For accurate name matching across papers and author names, irrelevant information such as comments or hyperlinks were first removed from the titles and all was made lowercase. A fuzzy-string matching algorithm was subsequently implemented using the FuzzyWuzzy v. 0.18.9 library in python to conduct name-matching, where splitting titles and names in ngrams of 5 was found to render the most optimal matching with a manageable margin of error. "Lexicons" were created for author names and paper titles to iteratively replace misspellings when identified. Matches above 80% similarity for titles and names were automatically accepted, matches between 50% to 80% similarity were subject to manual verification. Using the lexicons, author-to-author and paper-to-paper networks were constructed based on exact matching of names. Gender was assigned using the gender-guesser v. 0.4.0 library in python, subsequently subject to manual verification. We acknowledge that the authors may identify differently than we perceived their gender.

5 METHODOLOGY

Overarching analytical strategy. The analysis centred on two sets of data: *citing papers*, i.e. all LAK published papers, and *cited papers*, i.e. LAK papers that are cited by LAK papers. First, we reviewed descriptive statistics around the presence of women in author teams. Second, using exponential graph modelling of a LAK citation network, we evaluated the effect of commonly known factors on the presence of citation ties. Lastly, inspired by [5] we examined if appearance of papers in the reference lists was in line with the baseline expected from their association with the factors that influence citations. A rate of actual presence of WW, MM, WM, MW papers in the cited LAK papers that was higher or lower than this expected baseline would indicate the presence of bias.

Subsets of analysed data. We have analysed *citing papers* - published in LAK proceedings, and *cited* papers - cited by other LAK papers. Sensitivity checks were conducted on the subset of the cited papers - *cited without self-citation* . The definition of self-citation was adopted from prior work - if a reference authors included either the first or the last author of the citing paper. For example, in a paper where Jane was the first author, if the reference list contained a paper where she was a part of the author team, the cited paper was removed. If a paper authored by Jane where she was not the first nor the last author cited a paper where Jane was in the author team, the paper was retained.

Topics of papers. Each citing paper was manually assigned a topic. Our purpose here was to reflect a broader area, a tradition, or generic type of problem in which the paper was done, as it would recur at LAK. The first author with experience and exposure to the LAK scholarship, iteratively analysed paper titles and assigned topics. The following topics emerged: student behaviour (analysis of online trace data combined with other data sources, focused on measuring the process); social and collaborative learning; knowledge tracing, EDM, ITS, game-based learning; opinion pieces; studies reporting on specific infrastructure or tools; multimodal analytics; visualization, feedback, dashboards studies; student success (capturing also earlier predicting modelling efforts, focused on predicting performance); discourse (focused on analysis of text but not on the specific well-established area of application); writing; reading; recommender systems, papers focused on a new method; curriculum analytics; literature reviews; mixed (combining any two or more of the topics); design studies (human-centered learning analytics); automated content analysis (building classifiers); learning design; studies on ethics, fairness, and rigour (both quantitative and qualitative); self-regulated learning; institutional adoption; reports of the specific intervention, and other (1-2 studies on a niche topic that were combined into one category). Although there may be limitations in this topic assignment, our statistical analysis (reported later) supports that it was done in a meaningful manner.

Modelling citation network. We constructed a directed, unweighted paper-to-paper network to understand citation patterns in LAK proceedings. This network contained information about the paper's publication time (defined as ((publication year - 2011) + 1), paper's topic, team size, and team seniority (defined as the total LAK papers published by the first and last authors). Using exponential random graph modeling (ERGM), we assessed how the factors of seniority, topic, time, and team size affected citation probability. ERGM allows to model these effects simultaneously, estimating the log odds of a tie (here: a citation) given different attributes of a node (here: a paper).

Estimating the difference between expected and observed citation rates. In line with [5], we used a multinomial logistic regression [8], to predict the probability of a cited LAK paper to be MM, WM, MW, and WW, conditional on cited paper's seniority, paper's age, topic, and team size. These were operationalized in the same way as in the ERGM. An average of predicted probabilities per category estimated by the regression represented expected rates. Actual citation rates were calculated as the proportion of paper type being cited. To estimate the difference between expected citation rate and the actual citation rate for each paper type, e.g. WW, we used the following formula: (*observed probability* for WW minus *expected probability* for WW) divided by (*expected probability* for WW).

6 RESULTS

6.1 Author Composition of LAK papers

Presence of women across LAK papers. Table 1 describes the presence of women in citing, cited, and cited not self-citation papers (CNS). In *citing* papers, the number of female authors has grown from 22 in 2011 to 91 in 2022. However, this presence remained comparable across the years, at an average of 40%, relative to the growing total number of LAK authors at LAK. The average proportion of women authors in a paper authorship team has increased from 28% (2011) to 39% (2022). *Cited* LAK papers had fewer women. In *cited* papers the proportion of women per authorship team remained comparable to the citing papers - at around 37%. These numbers are not cumulative and should be seen as a positive trend: 32 women who published in 2021 were all cited in 2022, whereas 21 women who published in 2011 were cited throughout the decade.

Citing Papers. The citing papers were papers published in LAK Proceedings (2011-2022). These 833 papers were authored by 1708 unique authors, 660 of them (38%) were women. Some 115 (13%) of these papers were in the category WW (women as the first and the last author, solo authors included)); 212 (25%) were in the category WM (a woman as the first author and a man as the last author); 157 (19%) - in the category MW (a man as the first author and a woman as the last author); and 349 (42%) were MM (men as both the first and the last author, solo authors included).

A median number of authors per paper was four (*M*=3.8, *SD*=1.8, Max=13) and a median number of women authors per publication was one (*M*=1.4, *SD*=1.2, Max = 7). The papers were divided based on the median number of authors into smaller and bigger teams. An average number of female authors in small teams was one (35% of the team were women), and in big teams - two (37% of the team were women).

Our analysis does not explicitly consider the proportion of women within MM, MW, WM, WW papers. Figure 1 (top left) reports an average proportion of women authors across different paper types. MM papers on average have 12% of women, with variations between small and large size teams. WW teams are likely to have an average of 77% women authors. MW and WM papers have comparable number of women - just under 50%. This shows that MM paper is likely to have few women authors, or an WW paper likely to have few men authors. Fig. 1 (bottom left) shows how the number of WW, MM. WM, MW papers changed over time (non-cumulative). Overall the number of MM papers has slightly decreased, whereas the number of WW papers has slightly increased. We observe an increase in WM papers that presumably represents papers where a man author is a senior lead. Fig. 1 (top right) shows that the number of WW, MM, MW, and WM papers differs in different topics. Some are more balanced - such as *writing* and some are less balanced - such as *automated content analysis* . Three topics with highest numbers of papers are *student behaviour, social collaborative learning*, and *knowledge tracing, EDM, ITS, games.* Among them, *social and collaborative learning* is more balanced in terms of the numbers of WW, MW, WM, and MW papers.

Table 1: Descriptive statistics per year (A stands for total authors, W stands for Women authors, N - count)

Year	Citing		Cited		Cited No Self-Cites	
	A, N	W, N (%)	A, N	W, N (%)	A, N	W, N (%)
2011	55	22 (40)	52	21 (40)	29	12 (41)
2012	134	38 (28)	88	24 (27)	58	15 (25)
2013	143	41 (28)	88	27 (30)	51	18 (35)
2014	156	56 (36)	82	24 (29)	47	11 (23)
2015	246	88 (36)	151	54 (36)	100	32 (32)
2016	317	108 (34)	216	82 (38)	165	57 (35)
2017	367	153 (42)	187	77 (41)	125	47 (38)
2018	209	91 (44)	146	62 (42)	98	38 (39)
2019	212	81 (38)	120	43 (35)	80	24 (30)
2020	285	116 (40)	121	51 (42)	70	29 (41)
2021	271	112 (41)	78	32 (41)	33	14 (42)
2022	220	91 (41)	3	1 (33)	0	0

Cited Papers. The cited papers (N = 419) were those both published at LAK in 2011 - 2022 and cited by another LAK paper. These papers were a part of all references in LAK papers (N=3989). The cited papers were authored by unique 867 authors, 330 of them (38%) were women. Out of these, 53 (12%) were in the category WW; 112 (26%) were in the category WM; 79 (18%) - in the category MW; and 174 (42%) were MM. The median number of authors per cited paper and the presence of women in cited papers of different author teams were almost identical to the citing papers (hence, not reported). The presence of women in WW, MW, and WM teams was similar that in citing papers.

Cited No Self-Citations Papers (CNS Papers). The majority of statistical analysis was performed on the cited papers. We conducted sensitivity check to examine if the women representation in cited papers that were not self-citations (CNS) was similar. A total of 247 CNS papers (our of all 419 cited papers) were written by unique 643 authors. 235 of them (36%) were women. Out of these papers, 28 (11%) were in the category WW; 64 (26%) were in the category WM; 49 (20%) - in the category MW; and 106 (42%) were MM. A median number of authors per CNS paper was three (*M*=3.8, *SD*=1.8, *Max*=11). Women representation was otherwise similar to that in the cited papers. Women presence in MM, WW, WM, and MW papers was similar to that reported in cited papers.

6.2 Modelling Citation Network

LAK citation network had 833 nodes (papers) and 1353 edges (citations between them). The ERGM estimated how various factors affect the probability of a LAK paper being cited (Table 2). Distribution of networks simulated through these parameters had a reasonable goodness of fit. The model overestimated out-degree of

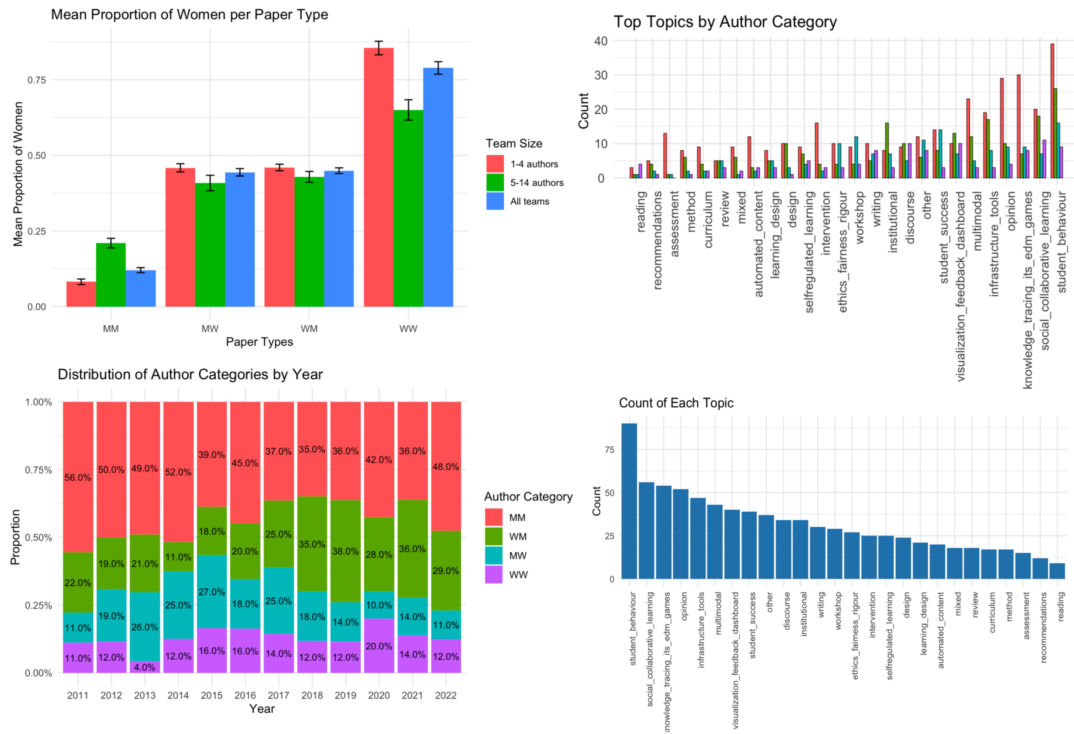

Figure 1: Citing Papers: top left - proportion of women authors in various types of papers in teams of varying size, top right - count of papers of various types across different LA topics, bottom left - types of papers published per year, bottom right - distribution of papers per labelled topics within LA

one, two and three; in-degree distribution was estimated correctly. The results show topics such as automated content analysis, design, ethics/fairness/rigour, review, self-regulated learning, and student success had a significant positive effect and larger odds of being cited; workshop papers and other papers have a significant negative effect, and low odds of being cited. Papers with senior authors were more likely to get cited. Papers published in the earlier years were more likely to get cited. Author team size had a negative effect on being cited. The papers were most likely to get cited by other papers on the same topic and by similarly senior authors. This in part captures the familiarity effect, as the seniority of authors is calculated by a number of papers that have published at LAK. Papers by more senior authors were likely to cite other LAK papers, also reflecting familiarity with LAK literature. Papers published later were more likely to cite more, most likely the papers published earlier. These results confirm well-known effects of why and how papers get cited. ERGM quantifies these effects, confirming their relevance to understanding citation patterns.

6.3 Actual Citation Rates against Expected Baseline

ERGM confirmed the role that diverse factors had on LAK papers being cited. If these factors were the only reason, then the actual citation probability of each paper would be no different from its conditional probability to be a paper of a particular type. To quantify the presence of the bias, if any, we examined the difference between the expected and observed citation rates in LAK cited

Table 2: ERGM output estimating the effect of diverse factors on whether a LAK paper gets cited

Factors	Coeff.	SE	Odds	p-value
Edges	-8.3	0.33	0	< 1e-04
Effects on being cited				
Seniority of a paper (log-transformed)	0.5	0.03	1.7	< 1e-04
Paper's age (higher - younger)	-0.2	0.01	0.8	< 1e-04
Author team size	-0.1	0.01	0.9	0.001
Effect of a topic on being cited	Controlled for			
Homophily effects				
If the topic is the same	1.8	0.1	6.6	< 1e-04
If the seniority of the team is similar	0.7	0.1	2.1	< 1e-04
Effects on citing other papers				
Seniority of paper's team	0.3	0.1	1.3	< 1e-04
Age of the paper	0.12	0.01	1.1	< 1e-04
AIC Null (BIC Null)	19591 (19602)			
AIC (BIC) Final Model	17642 (18020)			

papers (N=419) presented in Figure 2 top right, and in LAK cited no self-citation papers (N=247) - Figure 2 top left. The results suggest the presence of bias in citation patterns across all LAK authors. LAK authors under-cited MW and WW papers at around 9% less than expected given the topic, seniority, year of publication, team size. WM papers are 8.4% over-cited, whereas MM papers are 1.7% over-cited. We analyzed how different author teams are citing (Figure 2, bottom row). 349 MM citing papers tend to over-cited other MM papers at 22% higher than expected and under-cite WW papers at 45% lower than expected (Fig 2, bottom, a). They under-cite both

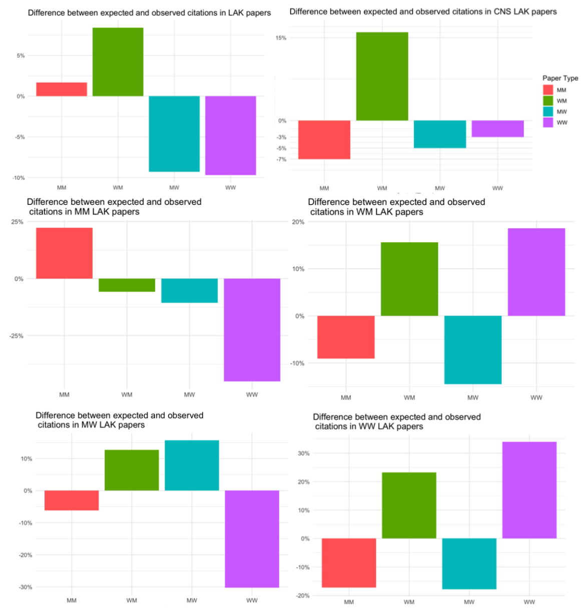

Figure 2: Over-/ Under-Citation: top left cited, top right in CNS, middle: left in MM cited, right in WM cited, bottom right in MW cited, left in WW cited.

WM and MW papers at 5.8% and 10.6% respectively. In contrast, 115 WW citing papers tend to over-cite WW papers at 34% more than expected and WM papers at 24% higher than expected. They under-cite MW and MM papers at around 17% lower than expected (Figure 2, bottom, b). Some 212 WM papers follow women-driven pattern under-citing MM papers (9%) and WM papers (14%), and over-citing WM papers (15%) and WW papers (18%), as shown in Figure 2 (bottom, c). Lastly, 157 MW papers have their own pattern as they under-cite both WW papers (30%) and MM papers (6%), and over-cited WM (12%) and MW papers (15%). The patterns suggest that it is the first author may be driving the choices of the papers, which in the LAK context makes sense since the citations in text are listed as numbers and not obvious to other team members reading drafted text. Finally, we checked if the patterns differed when self-citations were removed (Figure 2, top right). Without self-citations, all paper types were under-cited except for WM papers that are generally over-cited at 16% higher than expected.

7 DISCUSSION AND CONCLUSION

This paper examines if citation practices in learning analytics are equitable, in response to the evidence from other fields suggesting potential biases in modern citation practices. To this end, we analysed citations in papers published in ten years of LAK proceedings. We found that the number of female authors has grown, but it had remained stable relative to the total LAK author population. Overall the number of papers with the last author being a woman has decreased (MW and WW papers combined over time). MM papers have also decreased. The number of papers led by women, with men as last authors, has increased. A plausible explanation for that is a growing number of female doctoral students who are joining established labs. We also found that across LAK topics, the balance between MM, WW, MW, and WM papers varies, with some topics being more balanced than others. This potentially could explain some of the patterns of under- and over-citation (RQ3) with sub-community cultures and seminal work emerging according to the specific gender composition in those thematic sub-communities. Given the bias we discuss later, it seems important that sub-communities pay attention to the diversity in their citation practices and potentially discuss relevant strategies that will drive equitable knowledge practices within them.

The second research question examined the effect of the known factors driving citations. Analysis further confirmed their influence. Citations between papers on similar topics and between senior authors were most likely, again under-lying specific thematic work within LAK. Notably, some topics, such as automated content analysis, design, ethics/fairness/rigour, review, self-regulated learning, and student success were most likely to attract citations. The gender composition of author teams in these sub-communities may be also contributing to the observed biases. It also could be that in some communities, authors are more likely to build on the work presented at LAK, generating more knowledge production practices within the thematic groups. Factors such as familiarity may also play a role - as social networks of authors come into play. We did not model the effect of authorship networks but prior work suggests that they explain some but not all the observed biases.

The third research question evaluated if citation practices were only relying on the factors known to influence citations. Unfortunately, we found patterns of over- and under-citation among all paper types, but cumulatively they contributed to a 10% under-citing of papers where the first and the last authors were woman, and to 8.4% over-citing of papers with the first author woman and last author man. Following the logic that the last author is senior where the first author is a lead and often a PhD (which admittedly is not always the case), this may suggest that female senior scientists are at a disadvantage. The results suggest that choices of who to cite are gendered, and possibly driven by the first author and other team members (to remind you, MM papers have under 20% of female authors; WW papers have over 70% , whereas MW and WM have just under 50%).

Engaging in citation practices for equitable knowledge production is essential and can be addressed by mindful engagement with the reference lists that reflect the choices we make when we construct our arguments. A number of institutional policies at the level of *SOLAR* or *LAK* chairs or the *Journal of Learning Analytics*, such as those discussed earlier [15]can support equitable citation practices. Yet, their effective implementation requires discussions in the scholarly community, similar to the workshops conducted in the HCI community [18] prompted by relevant scholarship [11]. Our individual mindfulness in citations and ways we pass it on to doctoral students adds another dimension on how to address aspects of knowledge practices in ways that are suitable to our individual preferences and in line with larger societal issues. The data will be openly available so anyone can look further into the questions that we chose not to address, as well as look into their individual patterns of citations.

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