



Authorship conflicts in academia: an international cross-discipline survey

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Abstract

Collaboration among scholars has emerged as a significant characteristic of contemporary science. As a result, the number of authors listed in publications continues to rise steadily. Unfortunately, determining the authors to be included in the byline and their respective order entails multiple difficulties which often lead to conflicts. Despite the large volume of literature about conflicts in academia, it remains unclear how exactly these are distributed over the main socio-demographic properties, as well as the different types of interactions academics experience. To address this gap, we conducted an international and cross-disciplinary survey answered by 752 academics from 41 fields of research and 93 countries that statistically well-represent the overall academic workforce. Our findings are concerning and suggest that conflicts over authorship credit arise very early in one's academic career, even at the level of Master and Ph.D., and become increasingly common over time.

Keywords Academic conflicts · Credit distribution · Co-authorship · Advisor-advisee relationship · Academic collaboration.

Introduction

Scientific collaboration has become a prominent feature in modern science (Lee & Bozeman, 2005). Consequently, *sole authorship* (one publication-one author), which was a common practice until the twentieth century (Greene, 2007), has transformed over time to *co-authorship* (one publication-multiple authors) (Adams, 2013), with an ever-increasing number of authors lists on papers (Wuchty et al., 2007; Slone, 1996; Wang et al., 2019).

Unfortunately, determining *which* authors should be listed in the byline and their respective *order* encompasses multiple challenges (Lazebnik et al., 2022; Schymura & Löschel, 2012; Barta, 2022; Urbanska et al., 2019). Specifically, the inherent competition for jobs, promotions, grants, and recognition amongst researchers is often associated with

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self-interested behavior which may lead to *conflicts* over these two authorship credit distribution questions (authorship credit conflicts, for short) (Shrum et al., 2001; Bozeman & Corley, 2004; Bozeman et al., 2012; Urassa et al., 2021). Naturally, as the number of parties involved in collaborative research work increases, the magnitude and intensity of these conflicts increase proportionally (Borry et al., 2006; Fiiialka, 2019; Mansoor & Ameen, 2016). Regrettably, authorship credit conflicts may lead to a wide range of adverse consequences. For example, unjust distribution of credit may negatively affect individuals' academic and professional recognition, potentially limiting their opportunities for grants and promotions. Similarly, conflicts may discourage scholars from engaging in collaborative research thus impeding the progress of scientific knowledge and diminishing the potential societal impact of academic research.

In order to mitigate authorship credit conflicts and bring about a “fair and transparent” authorship credit distribution, journals have adopted formal criteria to define which contributors should be listed and, in some cases, even determine their appropriate order (Gasparyan et al., 2013). Several common criteria include, but not limited, to ICMJE-2009,¹ EASE-2011,² CSE-2012,³ and COPE-2008.⁴ These criteria generally agree that authorship credit should be limited to “individuals who have contributed in a meaningful and substantive way to its intellectual content” (Borry et al., 2006). However, these criteria may not always solve the authorship credit conflicts for several reasons: First, some guidelines may be open to interpretation. For example, it is not clear what is the minimal threshold for contribution to consider one's contribution to be “meaningful” enough to be listed as an author. In addition, as authorship norms may vary widely across different academic disciplines, what is considered a significant contribution or a typical credit distribution practice in one field may not be viewed the same way in another. Power dynamics within research teams, where senior researchers may have more influence, can also impact authorship credit distribution as junior researchers may feel pressured to concede authorship or credit due to concerns about career advancement or fear of repercussions. Moreover, it is rather simple to find cases in which the different formal criteria disagree (Gureev et al., 2019; Hesselmann et al., 2021). In parallel, several other solutions have been proposed to allow authors to better convey the role each party played in the collaboration work and the credit that should be associated with each co-author (Mentzelopoulos & Zakynthinos, 2017; Ilik et al., 2018; Vasilevsky et al., 2021). One popular solution is the *CRedit* (Contributor Role Taxonomy) system which requires authors to report the roles and contributions of each author separately based on fourteen different contribution types (Holcombe et al., 2021). Other common solutions to indicate varying levels of contributions include multiple first authors (i.e., co-first author) and multiple corresponding authors (i.e., co-corresponding authors) (Teixeira da Silva, 2021). Many consider these and other similar solutions to be important steps in the right direction (Fong & Wilhite, 2017). Nonetheless, these solutions may not completely solve authorship credit conflicts either. Particularly, authors may subjectively interpret their roles differently, present different disciplinary norms, and power dynamics and seniority may still be present.

Currently, there is only a very limited understanding of the extent and characteristics of the underlying phenomena (Kornhaber et al., 2015; da Silva, 2021; Lee &

¹ http://www.ease.org.uk/sites/default/files/ease_guidelines-june2011c.pdf

² http://www.icmje.org/ethical_1author.html

³ http://www.councilscienceeditors.org/files/public/entire_whitepaper.pdf

⁴ http://publicationethics.org/files/u2/All_flowcharts.pdf

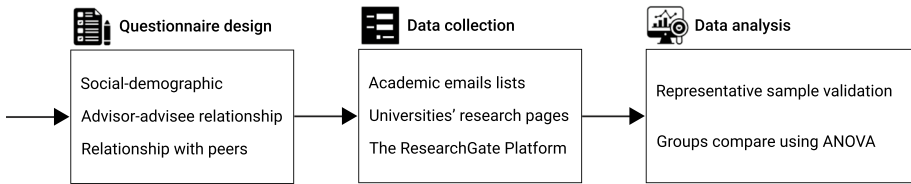


Fig. 1 A schematic view of the study’s methodological process

Deale, 2016). Specifically, existing literature investigating academic conflicts has predominantly considered individual research fields, countries or very specific types of conflicts in isolation (Gómez-Ferria et al., 2019; Mecca et al., 2015; Brunsmas et al., 2016; Seeman & House, 2015; Stein & Appel, 2021). Consequently, authorship credit distribution guidelines, criteria, and solutions are being developed and applied within a narrow context, lacking a comprehensive understanding of the problem they aim to address. In this work, we argue that the practical relevance of the proposed solutions, and perhaps the future development of novel more advanced ones, could be significantly improved by considering more comprehensive data that encompasses various fields of study, nations, and types of authorship conflicts. To that end, we report the results of an international cross-discipline survey targeted at estimating and characterizing authorship credit conflicts in academia. From a methodological standpoint, by asking researchers to anonymously report their prior experiences in authorship conflicts, we are provided with a unique opportunity to reveal data that is not directly observable otherwise. Specifically, examining and analysing published outputs of collaborative work, which is the common methodological instrument practiced by prior work in this context (O’Fallon & Butterfield, 2012; Bakhtiyari et al., 2014; Bailey, 2015; Macfarlane et al., 2014; Gargantini et al., 2022), can only attest to the final resolution of conflicts, and only if one had actually occurred. Unique to our survey is the distinction between seemingly symmetrical and obviously asymmetrical relations. Specifically, our study focuses on two standard types of academic relations: one between colleagues (i.e., a seemingly symmetrical relation) and one between an academic advisor and an advisee (i.e., an inherently asymmetrical relation). To the best of our knowledge, authorship conflicts in the advisor-advisee relationship have yet to be examined in prior literature and thus contribute a novel perspective on the matter.

The remainder of this article is organized as follows: Sect. 2 presents the data gathering and statistical analysis approaches. Then, Sect. 3 outlines the results followed by Sect. 4 which summarizes, interprets, and discusses the results in the wider context.

Materials and methods

From a methodological standpoint, we ask the scholars themselves about their behavior and experience. To gather the required data, we utilize an online survey approach. The survey was developed, distributed, and analysed as detailed below. Figure 1 shows a schematic view of the process.

Survey development

Inspired by previous studies which have developed surveys to study scholars' behaviors and preferences (Boyle et al., 2017; O'Laughlin & BischoffView, 2017; Crabb & Ekberg, 2014; Julien et al., 2014; Skakni et al., 2022), we designed a 24-item closed-form questionnaire consisted of four parts: First, socio-demographic questions (6 items); Second, work and publication patterns-related questions (3 items); Third, questions pertaining to potential authorship credit distribution conflicts with one's Masters and PhD advisor(s) ($6 \times 2 = 12$ items); Last, questions pertaining to potential authorship credit distribution conflicts with one's peers (3 items). The full set of items, as well as their possible closed-form answers and the motivation for their design, is provided in the Appendix.

The rationale of the survey, as presented to the respondents at the beginning of the survey, stated that "This survey intends to examine the extent and characteristics of disagreements in academic co-authorship.". We chose to use the term *disagreement* instead of conflict in this context in order to avoid inducing negative connotations.

Distribution

In order to reach as many researchers as possible we used an online questionnaire in the form of a Google form. All responses were kept confidentially and anonymously as clearly stated to the participants at the beginning of the questionnaire. The data was collected between July 2022 and November 2022. During this time, emails, as well as social media messages in the academic social media platform ResearchGate⁵ inviting researchers to participate in the survey, were sent. The targeted researchers were chosen manually based on their affiliation country and field of research, as self-evident or self-declared in their email's signature, ResearchGate profile, or personal website in order to obtain an adequate representation of the worldwide research workforce. Overall, 15,362 invitations were sent and a sample of 752 researchers from 93 countries and 41 fields of research was obtained (4.89% response rate). All participants had to acknowledge that they are actively conducting academic research in order to avoid non-relevant samples and provide their informed consent. The representativeness of the obtained sample is established next. The study was approved by the corresponding IRB.

Representative sample

We first establish that the obtained sample is, indeed, representative of the studied population. For this purpose, one has to show that the sampled data satisfies two primary conditions: (1) it is large enough, and 2) the measurable parameters' distribution that is known (or approximated) for the entire population is statistically indistinguishable from these of the sample (Grafström & Schelin, 2014; Gallagher et al., 2013; Omair, 2014).

First, under the assumption that all socio-demographic measures used in the questionnaire are normally distributed, we conducted a sample size power test (Rosner, 2010), assuming the overall number of academics is 10.26 million⁶ and a required p -value of

⁵ <https://www.researchgate.net/>

⁶ The *UNESCO Science Report* (Erocal, 2015) has estimated 7.8 million researchers at 2013 with 21% grows over six years, from 2007. We extrapolate these numbers by assuming that the growth rate is constant and computed a linear projection to 2022 by multiplying 7.8 by 1.315.

0.01. From this configuration, 667 or more samples are sufficient. Second, we analysed 22 past research papers which have used, presumably, representative samples of the academic community. For each paper, we manually extracted the sample size and computed the mean and standard deviation to be 429 ± 518 with a median of 257. A full description of the papers used in this analysis and their sample sizes are provided in the Appendix. Taken jointly, our sample size is larger than the minimal number of required participants according to the power test, 1.75 times larger than the average sample size and 2.92 times larger than the median one.

For the second condition, we used the age, gender, and national affiliation distributions of academics in the world as reported by the *UNESCO Science Report* (Erocal, 2015). We performed a Kolmogorov-Smirnov test (Berger & Zhou, 2014) between the entire population's characteristics and our co-distribution of these parameters, obtaining a p -value of $0.068 > 0.05$. Thus, the population is statistically well represented by our sample.

Analytical approach

The comparison of subsets of the data which fulfill some condition, e.g., male vs female respondents, is conducted using the χ^2 test (Pearson, 1900). When more than two groups are compared a χ^2 test is conducted, followed by a post-hoc χ^2 tests with Bonferroni Adjustment (Haynes, 2013). All statistical analysis was conducted using the Python programming language (Srinath, 2017), version 3.7.5. Unless stated otherwise, significance is determined at $p < 0.05$.

Due to a large number of possible national affiliations, for our analysis, we grouped them into continents following the definition of the OECD (Organisation for Economic Cooperation and Development).⁷ In a similar manner, the fields of research were grouped into five "disciplines" - Exact, Social, Nature, Engineering, and Medicine sciences, following UNESCO's methodology (Erocal, 2015).

Result

Our analysis consists of four parts: First, we report the main socio-demographic characteristic of our sample. Then, we analyze the extent and characteristics of conflicts by considering the advisor-advisee and peer relationships, separately. Last, we consider the interaction between the two analyses – that is, the possible link between one's conflicts as an advisee and one's subsequent conflicts with his/her peers.

Socio-demographics

Our sample consists of 752 academics, 517 (68.8%) of whom are male and 233 (31%) are female (2 participants opted not to identify their gender). In terms of age: 3.7% are below 25 years old, 21.7% are 26–35 years old, 30.2% are 36–45 years old, 24.3% are 46–55 years old, 13.8% are 55–65 and 6.3% are above 65 years of age. The participants vary in their most recently obtained academic rank as follows: 0.9% hold only a Bachelor's degree, 7.6%

⁷ For more information please refer to <https://www.oecd.org/about/document/ratification-oecd-convention.htm>

hold a Master's degree, 51.2% hold a PhD or MD, and 40.3% have reached a rank of Professor (either associate, full or emeritus). Similarly, the participants are primarily affiliated with 93 different countries all across the world with the three most prominent ones being the United States of America (USA) (9.3%), United Kingdom (8.6%), and Israel (7.3%). The participants also reported their main field of research to span over 41 different research subjects with the three most prominent ones being Mathematics (7.4%), Economics (6.8%), and Informatics (6.4%). Considering the participants' academic age (i.e., years passed since their first academic publication), 34.2% report 20 or more years, 24.3% report 10–20 years, 20.9% report 6–9 years, 13.8% report 3–5 years and the remaining 6.8% report less than 3 years.

Advisor-advisee conflicts

For the following analysis, we omitted the responses of those who reported having no advisor for the relevant period. For example, individuals who pursued a direct PhD were omitted from consideration under the Master's period analysis. Overall, 26 responses (3.3%) were omitted for Master's period analysis and 5 responses (<1%) were omitted from the PhD's period analysis. Overall, in our data, the ratio between those who had a single advisor and those who had multiple advisors is 4.8 (Masters) and 2.4 (PhD), the ratio between those who had a Professor as their main advisor and those who had not is 2.3 (Masters) and 15.9 (PhD), and the ratio between those who had a male primary advisor and those who had a female one is 5.5 (Masters) and 9.9 (PhD). Next, we consider each of the examined characteristics of the advisor(s)-advisee relationship and the associated conflict prevalence as reported in the two relevant questions of the survey – “Have you ever had a disagreement with your *Masters'* advisor(s) over authorship credit distribution (i.e., who should get authorship credit or how the author byline should be ordered)” and “Have you ever had a disagreement with your *PhD's (or MD)* advisor(s) over authorship credit distribution (i.e., who should get authorship credit or how the author byline should be ordered)”. Table 1 summarizes the main results.

Starting by considering all respondents together, 10.5% have reported having at least one authorship conflict with their Masters' advisor(s), whereas 16.3% reported the same for their PhD advisor(s). Statistically, respondents are more likely to report a conflict during their PhD with their advisor(s) compared to their Master's period, $p < 0.01$. In addition, respondents who had a conflict with their Masters' advisor(s) are significantly more likely to have a conflict with their PhD advisor(s) as well, 11.4% vs 17.2%, $p < 0.05$.

Considering the number of advisors, the results are mixed. First, having more than a single *Masters* advisor is associated with a significant *increase* in conflict prevalence (19.6% vs 8.7%) whereas having more than a single *PhD* advisor is associated with a significant *decrease* in conflict prevalence (17.6% vs 13.8%), both at $p < 0.05$. In addition, having a single PhD advisor is associated with a significantly higher conflict prevalence compared to having a single Masters advisor, $p < 0.01$.

In four out of the five examined disciplines (Exact, Social, Nature and Medicine) the prevalence of conflicts with one's PhD advisor(s) is higher compared to that with Masters advisor(s). However, the difference is only statistically significant for the Exact sciences for which the relevant respondents reported 17.1% conflict prevalence with their PhD advisor(s) compared to 11% conflict prevalence with their Masters advisor(s), $p < 0.05$. For the Engineering discipline, the opposite result is encountered with more conflicts encountered during the Masters period, yet the difference is not statistically significant.

Table 1 Characteristics of the advisor(s)-advisee relationship and the associated conflict prevalence (*N* is given in parentheses)

Characteristic		Masters	PhD	<i>p</i> value
Number of advisors	Single (562, 476)	8.7% (49)	17.6% (75)	0.003
	Multiple (114, 200)	19.6% (22)	13.8% (28)	0.298
	<i>p</i> value	0.030	0.019	-
Advisee's discipline	Exact (246)	11.0% (27)	17.1% (42)	0.037
	Social (184)	8.2% (15)	17.4% (32)	0.052
	Nature (88)	8.0% (7)	19.3% (17)	0.188
	Engineering (108)	16.7% (18)	9.3% (10)	0.083
	Medicine (50)	6.0% (3)	22.0% (11)	0.418
	<i>p</i> value	0.071	0.126	-
Advisee's gender	Male (469)	11.3% (49)	15.8% (74)	0.004
	Female (207)	8.2% (17)	18.4% (38)	0.026
	<i>p</i> value	0.069	0.040	-
Primary advisor's gender	Male (580, 617)	11.5% (67)	17.0% (105)	0.013
	Female (96, 59)	10.3% (10)	11.9% (7)	0.528
	<i>p</i> value	0.403	0.094	-
Gender concordance	Yes (205, 476)	11.0% (23)	15.8% (75)	0.062
	No (471, 200)	8.8% (41)	18.5% (37)	0.040
	<i>p</i> value	0.138	0.063	-
Primary advisor's title	Dr. (471, 35)	10.7% (50)	20.0% (7)	0.317
	Prof. (205, 641)	10.2% (21)	16.4% (105)	0.046
	<i>p</i> value	0.309	0.066	-
Age difference	Younger (2, 4)	0% (0)	0% (0)	-
	< 5 years (7, 10)	14.3% (1)	10.0% (1)	-
	5~10 years (52, 34)	7.7% (4)	14.7% (5)	0.419
	10~20 years (306, 176)	11.1% (34)	12.5% (22)	0.703
	20~40 years (247, 412)	9.7% (24)	19.9% (82)	0.038
	> 40 years (62, 40)	11.3% (7)	5% (2)	0.832
<i>p</i> value	0.183	0.067	-	
Papers published	0 (300, 18)	10.3% (31)	5.6% (1)	-
	1 (294, 59)	46.0% (135)	18.6% (11)	0.059
	2 (65, 156)	59.2% (38)	17.3% (27)	0.038
	3 (17, 234)	29.4% (5)	16.2% (38)	0.216
	4 (0, 107)	0% (0)	15.0% (16)	-
	5 (0, 102)	0% (0)	18.6% (19)	-
	<i>p</i> value	0.012	0.087	-
Continent	North America (86)	5.8% (5)	14.0% (12)	0.063
	South America (39)	10.3% (4)	35.9% (14)	0.057
	Europe (311)	9.3% (29)	15.4% (48)	0.040
	Africa (41)	19.5% (8)	29.3% (12)	0.093
	Asia (151)	11.3% (17)	12.6% (19)	0.214
	Oceania (49)	14.6% (7)	14.6% (7)	1.0
	<i>p</i> value	0.071	0.055	-

Table 1 (continued)

Characteristic		Masters	PhD	<i>p</i> value
Conflict during masters	Yes (70)	–	17.2% (12)	–
	No (606)	–	11.4% (69)	–
	<i>p</i> value	–	0.031	–
Overall		10.5% (75)	16.3% (115)	0.008

Turning to the issue of gender, we see that both male and female respondents are significantly more likely to report conflicts with their PhD advisor(s) compared to their Masters advisor(s). Specifically, 11.3% and 15.8% of all male respondents report a conflict with their Masters and PhD advisor(s), respectively, $p < 0.01$. Similarly, 8.2% and 18.4% of all female respondents report a conflict with their Masters and PhD advisor(s), respectively, $p < 0.05$. In addition, female respondents were found to have a conflict significantly more often with their PhD advisor(s) compared to their male counterparts, $p < 0.05$. Considering the primary advisor’s gender, we see that having a male PhD primary advisor is associated with more conflicts than having a male Masters primary advisor, $p < 0.05$. Otherwise, the primary advisor’s gender is not found to significantly associate with conflict prevalence. Regarding the issue of gender concordance (i.e., the primary advisor and the respondent’s gender alignment), we see that when the genders do not align, conflicts are more prevalent during the PhD period compared to the Masters period, $p < 0.05$.

Considering the primary advisor’s academic title, we see that having a Professor as the primary PhD advisor is associated with a significantly higher conflict prevalence than having a Professor as the primary Masters advisor, $p < 0.05$. Specifically, 16.4% of the respondents who had a Professor as their primary PhD advisor have reported a conflict compared to 10.2% of those who had a Professor as their primary Masters advisor. Otherwise, the primary advisor’s academic title is not found to significantly associate with conflict prevalence.

As for the age difference between the primary advisor and the advisee, we see that a 20–40 years difference is associated with a statistically significant increase in conflict prevalence from the Masters to the PhD period. Specifically, 19.9% of the relevant respondents have reported a conflict with thier PhD advisor(s) compared to 9.7% who reported a conflict with their Masters advisor(s). Otherwise, the age difference is not found to significantly associate with conflict prevalence.

Considering the number of published papers during the relevant period, we encounter only a single statistically significant difference. Specifically, 59.2% of the respondents who published two papers during their Masters reported a conflict with their advisor(s) compared to only 17.3% of the respondents who published two papers during their PhD significantly more the relevant training period, $p < 0.05$. Otherwise, the number of published papers is not found to significantly associate with conflict prevalence.

For all six examined continents, the prevalence of conflicts with one’s PhD advisor(s) is higher compared to that with Masters advisor(s). However, the difference is only statistically significant for Europe (15.4% vs 9.3%, $p < 0.05$), whereas the difference in North America (14% vs 5.8%), South America (35.9% vs 10.3%), Africa (29.3% vs 19.5%) and Asia (12.6% vs 11.3%) is not statistically significant.

Peer conflicts

Here, we consider the respondents' characteristics and the associated conflict prevalence as reported in the three relevant questions: 1) "Have you ever had a disagreement with a peer over authorship credit distribution (i.e., who should get authorship credit or how the author byline should be ordered)?" (we denote this question as *Conflict Faced*); 2) "Have you ever had to demand more authorship credit on a paper than that was initially assigned to you (i.e., get authorship credit or improve your placement in the author byline)?" (denoted as *Raised Demands*); and 3) "Have you ever faced a peer who raised demands to get more authorship credit than you believed s/he is entitled to (i.e., get authorship credit or improve his/her placement in the author byline)?" (denoted as *Others Demand*). Table 2 summarizes the main results.

Starting by considering all respondents together, we see that about one-half of all respondents have reported facing a conflict over authorship credit distribution with their peers (i.e., 48.9% reported "Yes" to "Conflict Faced"), demanded to get more authorship credit themselves (i.e., 53.1% reported "Yes" to "Raised Demands") and encountered peers who demanded to get more credit than that they are entitled to (i.e., 52.9% reported "Yes" to "Others Demand").

Starting with the issue of gender, Male respondents reported significantly higher conflict rates in terms of Raised demands (56.1% vs 50.2%) and Others Demand (48.1% vs 39.6%) but not in Conflict Faced (50.5% vs 54.6%).

Considering respondents' age, we see that older respondents tend to report higher conflict rates. Considering Conflict Faced, the conflict prevalence ranges from 26.8% for the 25–35 age group, to 74.4% for the above 65 age group with the prevalence rate monotonically increasing by age group, $p < 0.01$. Similarly, for the Raised Demands, the prevalence ranges from 38.4% for the 26–35 age group to 67.4% for the above 65 age group with the prevalence monotonically increasing by age group, $p < 0.05$. Albeit not statistically significant, a similar pattern is observed for the Others Demand, with the prevalence generally increasing from 28.3% for the 26–35 age group to 60% for the 56–65 age group. The slight decrease in conflict prevalence observed for the above 65 age group ("only" 53.5%) is presumably partially attributed with the lack of statistical significance. Similarly, considering the respondents' academic age, a similar pattern is observed with older respondents generally reporting higher conflict prevalence. Considering Conflict Faced, the conflict prevalence ranges from 23.9% for the 3–5 age group to 72.3% for the above 20 age group with the prevalence monotonically increasing by age group, $p < 0.05$. Likewise, considering Raised Demands, the conflict prevalence ranges from 39.1% for the 3–5 age group to 66.5% for the above 20 age group with the prevalence monotonically increasing by age group, $p < 0.05$. Again, albeit not statistically significant, a similar pattern is observed for the Others Demand with the prevalence generally increasing from 20.7% for the 3–5 age group to 56.6% for the above 20 age group, $p = 0.06$.

Similar to the age-based differences discussed above, the respondents' academic title is strongly associated with conflict rates as well. Specifically, Professors report higher conflict prevalence rates compared to Doctors (Conflict Faced: 71.1% vs 39.1%; Raised Demands: 66.3% vs 46.2%; and Others demand 58.4% vs 36.9%), all at $p < 0.01$.

Considering the respondents' workload, as represented by the number of concurrent projects pursued by the respondents, we see that a non-significant general trend where more concurrent projects are slightly associated with higher conflict prevalence.

Table 2 Characteristics of the respondent and the associated conflict prevalence (*N* is given in parentheses)

Characteristic		Conflict faced	Raised demands	Others demand
Gender	Male (469)	50.5% (237)	56.1% (263)	48.1% (226)
	Female (207)	54.6% (113)	50.2% (104)	39.6% (82)
	<i>p</i> value	0.208	0.058	0.041
Age	< 25 (4)	0% (0)	0% (0)	0% (0)
	26~35 (138)	26.8% (37)	38.4% (53)	28.3% (39)
	36~45 (216)	44.4% (96)	49.5% (107)	41.7% (90)
	46~55 (175)	64.0% (112)	64.6% (113)	54.9% (96)
	56~65 (100)	73.0% (73)	65.0% (65)	60.0% (60)
	> 65 (43)	74.4% (32)	67.4% (29)	53.5% (23)
	<i>p</i> value	0.009	0.045	0.060
Academic age	1~2 (17)	5.9% (1)	23.5% (4)	29.4% (5)
	3~5 (92)	23.9% (22)	39.1% (36)	20.7% (19)
	6~9 (146)	40.4% (59)	47.3% (69)	33.6% (49)
	10~20 (179)	52.0% (93)	54.2% (97)	54.7% (98)
	> 20 (242)	72.3% (175)	66.5% (161)	56.6% (137)
	<i>p</i> value	0.014	0.030	0.062
Title	Below Dr. (19)	0% (0)	21.0% (4)	15.8% (3)
	Dr. (366)	39.1% (143)	46.2% (169)	36.9% (135)
	Prof. (291)	71.1% (207)	66.3% (193)	58.4% (170)
	<i>p</i> value	0.001	0.004	0.004
#Projects	1 (78)	23.1% (18)	26.9% (21)	15.4% (12)
	2 (203)	40.9% (83)	49.8% (201)	31.0% (63)
	3 (185)	61.6% (114)	60.5% (112)	55.1% (102)
	4 (86)	60.5% (52)	65.1% (56)	57.0% (49)
	5+ (124)	66.9% (83)	62.1% (77)	66.1% (82)
	<i>p</i> value	0.081	0.099	0.050
#Co-authored papers	0 (21)	9.5% (2)	19.0% (4)	4.8% (1)
	1 (48)	22.9% (11)	33.3% (16)	12.5% (6)
	2~5 (127)	35.4% (45)	39.4% (50)	25.2% (32)
	5~9 (123)	40.7% (50)	54.5% (67)	39.0% (48)
	10+ (357)	67.8% (242)	64.4% (230)	61.9% (221)
<i>p</i> value	0.029	0.042	0.011	
#solo papers	0 (185)	27.6% (51)	42.2% (78)	27.0% (50)
	1 (80)	36.2% (29)	50.0% (40)	35.0% (28)
	2~5 (133)	66.2% (88)	54.9% (73)	63.9% (85)
	5~9 (125)	61.6% (77)	61.6% (77)	52.0% (65)
	10+ (153)	68.6% (105)	64.7% (99)	52.3% (80)
	<i>p</i> value	0.087	0.059	0.104

Table 2 (continued)

Characteristic		Conflict faced	Raised demands	Others demand
Continent	North America (86)	51.2% (44)	58.1% (50)	47.7% (41)
	South America (39)	66.7% (26)	53.8% (21)	51.3% (20)
	Europe (311)	53.4% (166)	52.4% (163)	46.0% (143)
	Africa (41)	43.9% (18)	63.4% (26)	46.3% (19)
	Asia (151)	49.7% (75)	51.0% (77)	43.7% (66)
	Oceania (49)	43.8% (21)	62.5% (31)	39.6% (19)
	<i>p</i> value	0.083	0.075	0.070
Overall		48.9% (368)	53.1% (399)	52.9% (398)

Table 3 Conflict prevalence across the three examined questions (*N* is given in parentheses)

		Conflict faced	Raised demands	Others demand
Conflict faced	Yes (350)		65.7% (230)	60.9% (213)
	No (326)		42.0% (137)	29.1% (95)
	<i>p</i> value		0.038	0.025
Raised demands	Yes (367)	62.7% (230)		57.5% (211)
	No (309)	38.8% (120)		31.4% (97)
	<i>p</i> value	0.018		0.016
Others demand	Yes (308)	69.2% (213)	68.5% (211)	
	No (368)	37.2% (137)	42.4% (155)	
	<i>p</i> value	0.033	0.026	

However, this trend is not statistically significant, possibly due to the extremely similar results observed for the cases of three, four and five+ concurrent projects.

Focusing on the respondents' publication patterns, we see that the number of co-authored papers is associated with conflict prevalence across the three examined questions, $p < 0.05$. Specifically, the single co-authored paper group reported 22.9% (Conflict Faced), 33.3% (Raised Demands) and 12.5% (Others Demand) compared to 67.8%, 64.4% and 61.9% reported by the 10+ co-authored group, respectively. This result is naturally aligned with those presented above considering one's age, academic age and title. When considering the number of solo papers, no statistically significant differences are found.

Turning to the connection between the three questions of interest, as can be seen in Table 3, the three seem to be highly interwoven. Specifically, providing a positive answer to any one of the three questions is strongly associated with increased chances of providing positive answers to the remaining two questions, $p < 0.05$. For example, those who reported Conflict Faced are significantly more likely to report Raised Demands (65.7% vs 42%) and Others Demand (60.9% vs 29.1%). Similarly, those who reported Raised Demands are significantly more likely to report Others Demand (57.5% vs 31.4%) and vice-versa (68.5% vs 43.4%).

Table 4 Characteristics of the respondent and the associated conflict prevalence (*N* is given in parentheses)

Past conflict		Conflict Faced	Raised demands	Others demand
Masters	No (606)	52.1% (316)	54.1% (328)	44.9% (272)
	Yes (70)	48.6% (34)	55.7% (39)	51.4% (36)
	<i>p</i> value	0.046	0.071	0.008
PhD	No (564)	49.6% (280)	53.2% (300)	43.6% (246)
	Yes (112)	62.5% (70)	59.8% (67)	55.4% (62)
	<i>p</i> value	0.006	0.028	0.009
Any	No (510)	49.4% (252)	52.7% (269)	43.5% (222)
	Yes (166)	59.0% (98)	59.0% (98)	51.8% (86)
	<i>p</i> value	0.002	0.027	0.040

Cross analysis

Last, we examine the possible link between authorship credit conflicts with one's Masters and/or PhD advisor(s) and his/her subsequent conflicts with his/her peers after graduation. As can be seen in Table 4, having a conflict with one's advisor(s) (either Masters and/or PhD) is associated with an increased rate of peer conflicts, all at $p < 0.05$. Specifically, those who reported a conflict with at least one of their advisors are significantly more likely to provide a positive answer to Conflict Faced (59% vs 49.4%), Raised Demands (59% vs 52.7%) and Others Demand (51.8% vs 43.5%). When breaking down the conflicts to conflicts with one's Masters and PhD advisor(s), we see that the PhD conflicts follow the same pattern, and present a statistically significant association with one's subsequent peer conflicts. Specifically, a conflict with one's PhD advisor is associated with higher Conflict Faced (62.5% vs 49.6%), Raised Demands (59.8% vs 53.2%) and Others Demand (55.4% vs 43.6%). However, a conflict with one's Masters advisor(s), follows the same pattern only for Others Demand (51.4% vs 44.9%). While the difference in Raised demands is statistically indistinguishable, for Conflict Faced we see the opposite trend, where those who reported a conflict with their Masters advisor(s) reporting *less* peer conflicts (48.6% vs 52.1%).

Discussion and conclusions

Our results combine to suggest a complex, arguably disturbing, multifaceted picture.

First, our results show that conflicts over authorship credit distribution are often encountered very early in one's academic career. Specifically, nearly one out of four participants have reported at least one conflict with an advisor either during their Masters and/or their PhD (24.5%). These conflicts are especially prominent during one's PhD training period, a period which is naturally longer, mostly more productive, and possibly more competitive than the Masters training one. Interestingly, those who had a conflict with their Masters advisor(s) are less likely to have a conflict with their PhD advisor(s). A reasonable explanation could pose that the advisees who encountered a conflict with their Masters advisor(s) have chosen a different advisor(s) when pursuing their PhD. Conflict prevalence with one's advisor(s) seems to be high despite some

non-consistent moderators such as the number of advisors, discipline, genders, titles, productivity, and geography.

Authorship credit distribution conflicts seem to intensify later on in one's career, this time in the form of "peer conflicts". Specifically, the results suggest that roughly one-half of the participants in this study have experienced a conflict with their peers. These conflicts seem to escalate with age and experience with older, more experienced, and more productive participants reporting higher conflict rates compared to their counterparts. Conflict prevalence with one's peers seems to be high despite some non-consistent moderators such as gender, workload, and geography.

Interestingly, those who had a conflict with an advisor during their training, either with their Masters advisor(s) and/or their PhD advisor(s), are more likely to encounter conflicts later on in their academic careers with their peers. We believe that this intriguing phenomenon can be explained in two, possibly complementary, ways. First, it may be the case that both types of conflicts are a consequence of one's personality and behavioral traits. For example, some scholars may be self-centered, egotistical, or even narcissistic, factors which are naturally associated with a more conflict-prone demeanor (Friedman et al., 2000; Bono et al., 2002; Ayub et al., 2017). Alternatively, conflict-prone advisors may have passed on certain academic norms, beliefs, and values to their advisees, causing them to follow a conflict-prone path, similar to how "parental influences" shape the development and choices of children later on in their lives (Cooper et al., 2013; Grote, 2003). For example, an advisee may have unwittingly adopted some contentious behaviors by modeling or mimicking a past advisor, behaviors which have led to the very conflict they had with that advisor. Given the great benefits and importance of mentoring in academia (Mengjiao et al., 2017; F Liénard et al., 2018; Rosenfeld & Maksimov, 2022; Lazebnik & Gorlitsky, 2023), a more in-depth investigation into this issue seems merited.

Taken jointly, our results strongly suggest a systematic challenge in academia rather than a small, confined phenomenon that could be attributed to "a few bad apples". Specifically, the consistency of the results across countries, fields of research, and most examined socio-demographic properties suggest that the issue is of a very large scale and should be treated as such. In addition, the fact that conflict-prone advisees "evolve" into conflict-prone scholars raises concerns about the current academic advisement practices. From a practical perspective, several potential measures can be adopted to tackle these concerning results: First, workshops and thinking groups of both young and seasoned researchers from diverse disciplines can facilitate insightful discussions on authorship ethics, practices, and standards. Such cross-disciplinary engagement can contribute to a nuanced understanding of authorship norms, fostering a culture of collaboration and mutual respect. Additionally, we suggest the implementation of training programs for both academic advisors and graduate students. These programs should focus on equipping scholars with conflict resolution skills, effective communication strategies, and an awareness of challenges related to authorship disputes. Adequate training can contribute to fostering a positive advising environment and mitigating future conflicts. Moreover, clear guidance on authorship expectations, responsibilities, and ethical considerations can contribute to establishing a more informed research community in the future.

In future work, we intend to investigate additional academic conflicts that may arise in other interactions academics have. For example, a scholar may act as a reviewer or committee member for a grant proposal or a submitted paper for consideration. In these settings, that scholar may be tempted to leverage his/her role and act in a self-interested way by providing a negative review for a competing proposal or requesting additional references to specific works s/he authored in the past. Unfolding the unique dynamics in such settings can help establish a more complete understanding of potential conflicts in academia and can be instrumental in developing new policies to mitigate such potential conflicts. In addition, note that this study is based on the self-reported past experiences of the participants, which be subjected to potential biases and/or inaccuracies. Thus, future work can adopt a longitudinal perspective and track conflicts as they occur and evolve over time and consider them case-by-case in a qualitative manner. Finally, one may adopt qualitative methods (such as interviews) to better understand the complexities and nuances of authorship conflicts.

Appendix

Questionnaire

Here, we provide the questionnaire's questions and possible answers:

- “Gender”: Male, Female, Prefer not to say.
- “Age”: 18–25, 26–35, 36–45, 46–55, 56–65, 66+
- “Academic degree”: First, Second, Third, Professor
- “Main field of research”: Informatics, Computer Science (CS), Environmental science, Social sciences, Philosophy, Literature, Linguistics, History, Law, Politics, Economics, Management, Sociology, Psychology, Nano/Micro science, Applied physics, Mathematics, Physics, Chemistry, Mechanical engineering, Electrical and electronic engineering, Civil engineering, Architecture and building engineering, Material engineering, Process/Chemical engineering, Neuroscience, Oncology, Genome science, Biological Science, Basic biology, Anthropology, Animal life science, Pharmacy, Basic medicine, Boundary medicine, Society medicine, Clinical internal medicine, Clinical surgery, Dentistry, Nursing.
- “How many years have passed since your first academic publication (i.e., what is your academic age)”: 0, 1–2, 3–5, 6–9, 10–20, 20+.
- “Country of primary affiliation”: a list of 196 countries from <https://gist.github.com/kalinchernev/486393efcca01623b18d>.
- “Based on the last 5 years, on average, how many research projects do pursue concurrently?": 1, 2, 3, 4, 5+.
- “How many academic papers have you published thus far with one or more co-author(s) *other than your advisor(s)*?”: 0, 1, 2–5, 6–10, 10+.
- “How many academic papers have you published with no co-authors (i.e., solo papers)?”: 0, 1, 2–5, 6–10, 10+.
- “How many advisors did you have during your Masters training period?”: 1, 2, More than 2, I don't have a Masters.
- “How many papers did you publish during your Masters with your advisor(s)?”: 0, 1, 2, 3+.

Table 5 Questionnaire-based paper about academia with their cohort sizes

Title	Group invited size	Group participant size	Source
Balancing parenthood and academia: work/family stress as influenced by gender and tenure status	264	264	Boyle et al. (2017)
Retaining female postgraduates in academia: the role of gender and prospective parenthood	249	249	O’Laughlin & BischoffView (2017)
Minority under representation in academia: factors impacting careers of surgery residents	3726	1217	Crabb and Ekberg (2014)
Ready for careers within and beyond academia? Assessing career competencies amongst junior researchers	727	727	Julien et al. (2014)
The influence of gender role conflicts & academic stress coping ability, and social support on adaptations to college life among male nursing students	225	225	Skakni et al. (2022)
Ethical problems, conflicts and beliefs of small business professionals	1300	135	Hae-Ok and Eun-Yi (2014)
Academic stress among college students: comparison of american and international students	392	392	Vitell et al. (2000)
Social support from work and family domains as an antecedent or moderator of work-family conflicts?	107	107	Misra and Castillo (2004)
Measuring acculturation gap conflicts among hispanics: implications for psychosocial and academic adjustment	283	283	Seiger and Wiese (2009)
Work to family, family to work conflicts and work family balance as predictors of job satisfaction of Malaysian academic community	280	280	Basáñez et al. (2013)
Marital conflicts on academic performance of secondary school students in port harcourt metropolis, rivers state	1951	195	Rahman et al. (2020)
Financial conflicts of interest, conflict of interest, and academic discipline	10	10	Wami et al. (2021)
Torn between study and leisure: How motivational conflicts relate to students’ academic and social adaptation	733	733	Bruton et al. (2016)
Perceptions of scholars in the field of economics on co-authorship associations: evidence from an international survey	580	580	Grund et al. (2014)
Misuse of Coauthorship in Medical Theses in Sweden	285	285	Kumar and Ratnavelu (2016)
Measuring dissatisfaction with coauthorship: an empirical approach based on the researchers’ perception	2344	2344	Helgesson et al. (2018)
Coauthors’ Contributions to Major Papers Published in the <i>AJR</i>	272	196	Gómez-Ferría et al. (2019)
An examination of ethical research conduct by experienced and novice accounting academics	176	176	Slone (1996)

Table 5 (continued)

Title	Group invited size	Group participant size	Source
Honorary coauthorship: does it matter?	195	127	Meyer and McMahon (2004)
Authorship conflict in Bangladesh: an exploratory study	100	100	O'Brien et al. (2009)
The influence of early research experience in medical school on the decision to intercalate and future career in clinical academia: a questionnaire study	117	66	Ahmed et al. (2010)
A Study of Awareness of Authorship Criteria among Academic Plastic Surgeons	916	744	Reinisch et al. (2010)
Mean ± standard deviation	692 ± 908	429 ± 518	

- “How many advisors did you have during your Ph.D. training period?”: 1, 2, 3, 4, 5.
- “How many papers did you publish during your Ph.D. studies with your advisor(s)?”: 1, 2, 3, 4, 5+.
- “How many years your primary Masters advisor is older than you?”: Younger than me, 0–5, 5–10, 10–20, 20–40, 40+.
- “What was your primary Masters advisor’s academic title?”: Dr, Prof.
- “What was your primary Masters advisor’s gender?”: Male, Female.
- “Have you ever had a disagreement with your Masters’ advisor(s) over authorship credit distribution (i.e., who should get authorship credit or how the author byline should be ordered) ?”: Yes, No.
- “How many years your primary Ph.D.’s (or MD) advisor was older than you?”: Younger than me, 0–5, 5–10, 10–20, 20–40, 40+.
- “What was your primary Ph.D. (or MD) advisor’s gender?”: Male, Female.
- “Have you ever had a disagreement with your PhD’s (or MD) advisor(s) over authorship credit distribution (i.e., who should get authorship credit or how the author byline should be ordered) ?”: Yes, No.
- “What was your Ph.D.’s (or MD) primary advisor’s academic title?”: Yes, No.
- “Have you ever had a disagreement with a peer over authorship credit distribution (i.e., who should get authorship credit or how the author byline should be ordered) ?”: Yes, No.
- “Have you ever had to demand more authorship credit on a paper than that was initially assigned to you (i.e., get authorship credit or improve your placement in the author byline) ?”: Yes, No.
- “Have you ever faced a peer who raised demands to get more authorship credit than you believed s/he is entitled to (i.e., get authorship credit or improve his/her placement in the author byline) ?”: Yes, No.

The questions and possible answers were devised based on prior literature (Boyle et al., 2017; O’Laughlin & BischoffView, 2017; Crabb & Ekberg, 2014; Julien et al., 2014; Skakni et al., 2022). Specifically, the first three questions are used as socio-demographic indicators broadly used in social sciences and scientometrics. Afterward, the main field of research and academic age are asked to obtain academic-related socio-demographic indicators. The country of primary affiliation is requested to study the dynamics in different countries and cultures. The following question about the number of projects was included to roughly differ the levels of activity of the participants. Clearly, research projects are not identical and without clear formalization. Nonetheless, the nature of research is also non-deterministic which means this value can, arguably, be a useful approximation. The next three questions target the so-called maturity of the participant, assuming that after 10 papers, the participant is an active scholar (Rosenfeld & Maksimov, 2022). Next, a series of questions over one’s Ph.D. and Master training periods are included to measure both the personal properties of the participant and his/her advisor(s) as well as the prevalence of conflicts between them. Finally, the last three questions are focused on conflicts with one’s peers. The survey was piloted among a subset of researchers from the authors’ institutes. During this phase, the phrasing was improved and small typos were corrected.

Cohort size comparison dataset

Table 5 summarizes 22 studies about social and political practices in academia that are based on questionnaires.

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