Salaries in Higher Education Systems:

A System-wide Perspective on Career Advancement and Gender Equity

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Abstract

Despite gains in academic participation, women still face gender disparity in salary among Science, Technology, Engineering, and Math (STEM) fields. Although this finding is prevalent across the literature, most studies have been conducted within a single institution or field. Here, we determine the extent to which gender inequality in salaries exists across STEM faculty of a regental state system in the Midwestern United States. Salaries of STEM faculty across nine years were collected from the six state institutions within that regental system. Controlling for rank, year, and length of service, female STEM faculty earned significantly less than their male counterparts and these disparities were evident even within the first year of service. As percentage-based increases in salary will not remove the existing gender-based inequity among salaries, other system-wide policies are likely needed to address current levels of gender inequity.

Keywords: STEM fields, salary equality, board of regents

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Although women have made considerable gains over the last few decades in academic participation, there is persistent evidence that, on average, female faculty receive lower salaries than their male counterparts (AAUP, 2019; Barbezat & Hughes, 2005; Bichsel & McChesney, 2019; Frances, 2017; Gordon, Morton, & Braden, 1974; Kim, 2011; Olivetti & Petrongolo, 2008; Perna, 2001; Umbach, 2007; Webber & Canché, 2015). Although salary inequality between the genders is caused by many factors, starting salaries for women tend to be lower than men (Cropsey et al., 2008; Curtis, 2010; Freund, 2016); these cannot be overcome when raise systems with percentage increases are employed (Hearn, 1999). Unsurprisingly, salary is related to job satisfaction (Hagedorn, 1996) and is often cited as a common reason for any individual leaving an institution (AAUP, 2019; Cropsey et al., 2008; Heckert & Farabee, 2006; Trotman & Brown, 2005). However, in addition to faculty concerns, because hiring new faculty is often more costly, it can be significant cost savings for universities to retain existing faculty (Boushey & Glynn, 2012).

Unfortunately, not much progress on the academic gender wage gap has been made: even the most recent (2018-2019) report of the American Association of University Professors (AAUP) suggests that progress toward gender equity in academic salaries since the mid-1970s has been slow (AAUP, 2019). Although a multi-faceted problem, they attribute differences in the average full-time salaries between genders to women remaining underrepresented at research universities, at full professor ranks, and in disciplines earning higher salaries on average; this is despite an overall increase in female representation across institutions of higher learning (AAUP, 2019). One area where men still far outnumber women is in the STEM (Science, Technology, Engineering, and Math) fields (reviewed in Kahn & Ginther, 2017), and known wage gaps exist between the genders in these fields (Lim, 2016; Xu, 2017). Despite earning an equal number of STEM PhDs, women account for less than 30% of the total STEM workforce (National Science Board, 2018; Johnson, 2017). The reasons for the difference in numbers between men and women are multi-faceted and include societal biases and stereotypes, early educational gaps, and family commitments leading to work-life balance conflict (reviewed in Kahn & Ginther, 2017). In academia, recruiting and maintaining female faculty is important not only to diversify a department, but because they also provide mentorship to female students, increasing retention of those students in STEM fields in the future (Drury, Siy, & Cheryan, 2011; Poor & Brown, 2013; Rowland, 2018). Indeed, departments with more female faculty tend to have more female students (Torrence & Kiesow, 2017). Unfortunately, once hired, women tend to leave academia at a higher rate than men (Rice, 2012; Dasgupta, 2017). One reason that may contribute to the difficulty universities have in recruiting and retaining female STEM faculty is a general disparity in salaries between men and women in the STEM fields (Christensen, 2018; Gardner, 2013).

Many examples exist demonstrating persistent differences in salary between men and women in the STEM fields. Here, we look to extend that research by focusing on STEM faculty in an entire, state-wide public regental system. State university systems are common throughout the United States in which a single administrative entity, such as a Board of Regents, determines policies, such as salary policy, for a group of public institutions in that state. Specifically, we focus on the regental university system of South Dakota, a group of six public 4-year universities within the state. Although these six universities differ in institutional priorities (*i.e.*, research versus undergraduate instruction), policies – including salary policy – are uniformly determined by the South Dakota Board of Regents (SDBOR). Throughout the period of this study, salaries for faculty within SD's regental universities were determined based on contractual agreements between the SDBOR and the state's COHE (Commission on Higher Education) group, Classification of Instructional Programs (CIP) codes determined by area of specialization, market, performance, and institutional priorities. Salary increases were determined through percentage increases, which were determined yearly without consideration for starting salary amount. Here, we consider how gender influences STEM salaries across the SD regental university system which will help to inform whether system-wide policies are needed in relation to gender equity.

Methods

With the assistance of their provosts and human resource offices, the authors collected data from each of the institutions over nine academic years (2011-2020). Only tenured or tenure-track non-administrative faculty were included. Data included individual name, salary, calendar year, rank (*i.e.*, assistant, associate, or full professor), full time equivalence (FTE), CIP code, date of hire, and gender. From this information, we determined length of service (from year of hire to current year of data) and controlled salary for FTE. As STEM faculty were the focus of the current study, only faculty with STEM CIP codes (as defined by NSF (Manly, Wells, & Kommers, 2018; NSF, 2015)) were analyzed. Overall, salaries were used from a total of 575 individuals between 2011 and 2020; of those, most worked in the BOR system for multiple years and thus have repeat salaries across that time.

Salaries were analyzed using mixed models with the lme4 (Bates, Mächler, Bolker, & Walker, 2014) and lmerTest (Kuznetsova, Brockhoff, & Christensen, 2017) packages in R (R Team, 2019). Specifically, salary (controlled for FTE) was included as the dependent factor and gender as the independent; calendar year, length of service, and rank were included as co-factors and individual (*i.e.*, name) was included as a random factor to account for multiple salaries across years for a single individual.

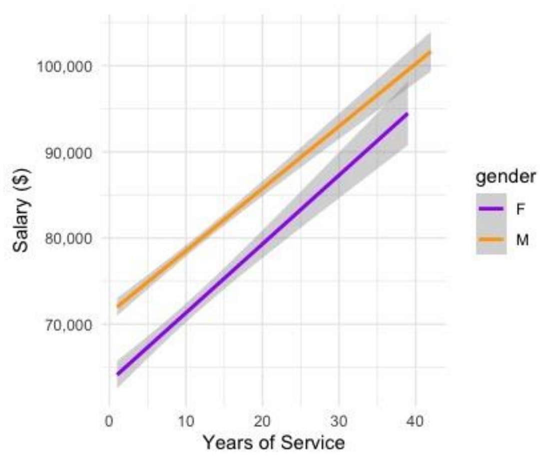
Results

Of the 575 STEM faculty considered in this study, only 137, or 23.8%, were women. However, when considering full professors only (*i.e*., presumably those earning a higher salary), the percentage of women in the STEM fields was even lower (*i.e.*, 34 of 197 total full professors were women, or 17.3%).

Controlling for rank, length of service, and year, we found significant differences in STEM salaries between men and women (F= 39.30, p<0.0001; *d*= 0.48; Figure 1). Specifically, on average, male STEM faculty made $6,372 (+/- $597) a year more than female STEM faculty over the time period of this study. All co-factors included (*i.e.*, rank, length of service, and year) also positively predicted variation in salary (Table 1).

Figure 1

Overall gender disparity in salary among STEM faculty within SDBOR system between 2011 and 2020



Note. Female STEM faculty make less than their male counterparts over time. Figure shows average men's (mustard) and women's (purple) salaries by number of years of service +/- standard error (in gray).

Table 1

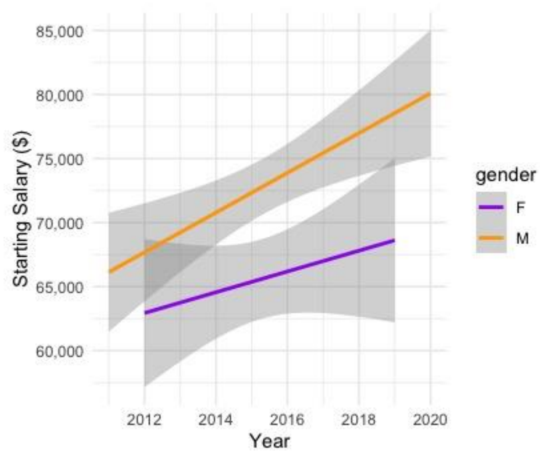
Statistical summary of co-factors in model describing variation in salary

Co-Factor	**F, p-value**
Rank	238.41, p<0.0001
Length of Service	31.61, p<0.0001
Year	1156.61, p<0.001

Interestingly, gender disparities were evident even within the first year of service within the SDBOR system. Of the 176 individuals that were hired to work for their first year within the interval analyzed, only 26.7% were women. Further, male STEM faculty received a $6,239 (+/- $1,878) higher first year salary (F=6.45, p=0.02; *d*= 0.57) than their female counterparts (Figure 2) taking rank (F=18.29, p<0.0001) and year (F=12.99, p=0.0004) into account.

Figure 2

Gender disparity in starting salary among STEM faculty within SDBOR system



Note. Female STEM faculty make less in their first year than their male counterparts. Figure shows average men's (mustard) and women's (purple) starting salaries by year +/- standard error (in gray).

Discussion and Implications

Similar to national averages (National Science Board, 2018; Johnson, 2017), female STEM faculty make up less than 25% of the total number of STEM faculty within the SDBOR system; the proportion of women is even lower at the full professor rank (however, whether this is a result of women not being promoted to full professor or leaving before being promoted, is not yet known). Further, similar to other studies, we found that within the SD regental system, male faculty in the STEM fields are paid a significantly higher salary than female faculty. These differences begin in the year of hire and is perpetuated throughout employment. Unfortunately, our data suggest that these problems have remained consistent across time, as not only are existing salary disparities consistent across the time analyzed, but women are consistently being hired at a lower rate into the STEM fields in the SDBOR system. This indicates more work needs to be done at the system level to address differences between men and women in STEM in SD higher education. Although we did not have the data to address further disparities in the salary data (*e.g.*, racial disparities or disparities in specific fields of STEM), other research suggests such disparities exist, perhaps exasperating already noticeable divides in salary equity; future research should continue to study salary inequality among other minority groups and in specific fields, in South Dakota and elsewhere.

The underlying causes of inequity of salary between STEM men and women in the SDBOR system is not yet known. However, the consistency in these differences across time at least indicates that salary data are not consistently examined for gender bias to help drive change. In systems such as the SDBOR, where salary increases are determined by yearly percentage increases, any disparity in gender salary at hire, such as is evidenced here, is likely to be perpetuated throughout the employment of those individuals. However, even when salary increases are not given as a percentage increase, raises are not always equitable or transparent. For instance, at one Midwestern university, although men's salaries increased as their teaching evaluations went up, women's salaries went down as course evaluations went up (Magel, Doetkott, & Cao, 2017). Further, although the results presented here might indicate that women should negotiate more for higher initial salaries, previous research shows that even initial negotiations tend to be inequitable where negotiating can increase starting (and therefore subsequent) salary for men, but not women (Claypool, Janssen, Kim, & Mitchell, 2017). Within the SDBOR system, there is very little ability to negotiate or adjust salaries. There is a “top-down” approach, leaving very little room to account for differences in salary among gender as well as disciplines. This problem not only affects current female faculty but has a direct effect on retention and recruitment efforts of future female faculty and their students (National Research Council, 2006). Notably, policy survey data within the SDBOR faculty indicate faculty believe more attention needs to be paid to the salary equity policy of the SDBOR (*unpublished data*). To facilitate such change and ensure recruitment, retention, and career advancement of women in the STEM fields throughout the SDBOR, we recommend taking a data driven approach to salary inequity.

As awareness of the wage gap grows around the world, policies are being put into place to decrease these discrepancies. For instance, some suggest that not prohibiting workers from discussing pay and even making salaries public, allowing for salary transparency, is one impactful way to reduce the gender wage gap (Canales, 2017; IRLE, 2018; Tarr, 2018). Such policies allow analyses to identify whether or not pay gaps exist and promote resolutions. For instance, after salary transparency laws were put into place and better enforced in Canada, the gender pay gap between men and women in academia decreased by ~30%, with additional suggestive evidence that this change was driven by increases in women’s salaries (Baker, Halberstam, Kroft, Mas, & Messacar, 2019). In South Dakota, all state employee names and salaries are listed on a public website called OpenSD – SD Transparency Website (South Dakota

Bureau of Finance and Management, 2020); unfortunately, increased salary transparency has not yet facilitated change in the STEM gender wage gap in South Dakota, indicating more needs to be done.

Beyond disparities in salary, this study evidenced a significant difference in the number of women in the STEM faculty ranks within the SDBOR system. Some have blamed a “leaky pipeline” for the lack of female faculty in the STEM fields, (*e.g.*, (Leboy, 2008)), suggesting fewer available women for those roles. However, similar numbers of women obtain higher degrees as men in STEM fields (National Science Board, 2018; Johnson, 2017), indicating many women drop out of the field following completion of their education. This is likely a result of a lack of recruitment and promotion of women in the STEM fields, which is supported by the literature. For instance, science faculty rate identical resumes with male names higher than those with female names and were willing to offer higher salaries to the male applciants (Moss-Racusin, Dovidio, Brescoll, Graham & Handelsman, 2012). Within the data presented here, we show fewer women than men are hired at the assistant professor level in the SDBOR system, which is then even further reduced at the full professor level. If more were done to recruit and promote women at all levels within the STEM fields, this alone would increase women’s salary standing as they become promoted through the ranks to full professor. Research suggests that techniques as easy as advertising in venues targeted at women (*e.g.,* Committee on Women in Science in Engineering) increase the number of female applicants, and thus the likelihood a woman is hired (Glass & Minnotte, 2010). In addition, many universities have implemented policies and best practices recommendations such as alternative tenure clocks, childcare, and paid leave policies to increase gender integration among faculty. Finally, to increase promotion chances after being hired, it is recommended that women are mentored by other women in the field, refuse extraneous or gendered requests for service (*e.g.*, working with children, or serving on committees as a "token female"), and demand considerations for work and family life balance (Bonawitz & Andel, 2009; Thomas, Bystydzienski, & Desai, 2015).

Conclusion

The data presented here add to the large body of evidence showing that disparities exist between men and women in salaries, particularly in the STEM fields. As with many organizations, the reasons for these disparities are nuanced and multi-faceted. As such, a data driven approach should be used to address gender disparities, with organizations first performing a pay equity audit to address where pay disparities exist and what operational gaps need to be addressed to resolve them.

We hope that by identifying the existing disparities between genders in salary compensation of STEM faculty at the SDBOR, we will provide the opportunity for faculty to work with the BOR to achieve a common, system-wide practice of handling all aspects related to human resources and employee management, such as salary negotiations, salary schedules to mitigate existing disparity, and policies to remove gender biased pay. To that end, the authors have already begun working with the BOR to improve salary and promotion equity within the state system by suggesting and implementing policy changes. Similar discussions between faculty and administration are likely necessary across academic institutions. Such discussions may be increasingly important as academia changes at an unprecedented rate in response to COVID-19; as faculty positions are reduced or cut, institutions must determine whether women are being disproportionately affected by these decisions (Malisch et al., 2020). For instance, if salaries are reduced to offset the financial burden of the university, institutions should first assess pay equity and not make uniform cuts (Malisch et al., 2020). We anticipate that by changing policy and equalizing salary, morale will be changed, leading to a more positive workplace, increased productivity, and higher retention of faculty, thus allowing an environment where females and males can achieve their potential and be fairly rewarded for the work they do. Finally, since having female faculty as role models can promote participation and retention of female students in STEM fields, addressing gender disparity in STEM pay now is expected to have considerable knock-down effects for the field in the future.

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