University of California, Merced

Closing the Racial and Gender Gap in Science

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Introduction

The sciences have greatly remained dominated by men, regardless of the many attempts and initiatives to end the gender and racial inequalities. Women and people of color have remained underrepresented throughout society and academia. There are less female full professors, even though there are more female than male undergraduates and graduates in the United States (2). According to the U.S Department of Commerce (4), women work close to half of all jobs in the U.S economy, yet only less than 25% of women hold STEM jobs. Women who have STEM degrees are also more likely to have education or healthcare related jobs as opposed to a STEM occupation.

As for underrepresented minority groups, they only constitute about 30% of the U.S population of STEM workers. When it comes to contributions and authorship, women and people of color were significantly less likely to publish and obtain first authorships. In the last two decades, men self-cited 70% more than women, which indicates that the gender-gap in self-citation has remained consistent within the last 50 years (1). As the degrees in STEM continue to rise, the disparities in the field will remain, unless changes are implemented.

The purpose of this study was to demonstrate how the newest University of California has impacted the experiences of undergraduates and graduate students. The University of California, Merced is ranked one of the

most ethnically and culturally diverse student body and faculty among all the ten University of California campuses. About 54.7% of undergraduate students are of Hispanic ethnicity, 20% are of Asian/Pacific Islander ethnicity, and 4.5% are of African-American ethnicity. UC Merced is at the forefront of the UC system with the highest percentage of students from underrepresented ethnic groups. Additionally, 51.4% of the students attending UC Merced are female, while 47.7% are male. As the newest UC and the first 21st research university, UC Merced has provided ample research opportunities with equal representation of all its students. These characteristics embodied by this institution have positively shaped the experiences of many undergraduate, graduate students, and postdocs. Could the University of California, Merced potentially serve as a model for improving the gender-gap and equal representation that is visibly observed in older and bigger academic institutions?

In this study, interviews were conducted in order to observe and collect similar experiences within participants' responses about their writing, research, and the exclusion of underrepresented groups in science such as women and people of color. The main focus of this study was on gender inequality, racial bias, and discrimination placed upon the scholarly, peer review process as it is the base of scientific publishing. The results collected were to provide solutions to these ongoing issues in order to create a more diverse and inclusive environment within academic institutions, workplaces, and science, technology, engineering, and mathematics (STEM) fields. The

purpose of doing so will shed a light on the barrier gaps in STEM related fields.

Materials and Methods

The experiment involved a total of fourteen participants that were either undergraduate or graduate students from the University of California, Merced. Participants were interviewed and asked a series of questions involving their experiences in writing and research while attending UC Merced. Detailed steps of the experimental step-up are provided in the following sections.

Selection of Participants

In order to obtain interviews for the experiment, emails were sent to various individuals from the W-STEM group of the University of California, Merced, as well as, reaching out to individuals from personal connections. In addition, emails were sent to several graduate students from the School of Natural Sciences using the University of California, Merced directory. The W-STEM group was selected due to their mentoring and advocating issues for women in the STEM field. The email asked individuals if they were interested in participating in an interview and the intent and purpose of the interview. If individuals were interested and agreed to participate, a second email was sent to arrange the time and location the interview would take place.

Participants were selected based off of their research experience, their writing courses they have taken and their majors. All participants were from the University of California, Merced and involved five graduate students and nine undergraduate students all diverse in major, year, and ethnicity.

Interview Process

Participants were asked a series of questions pertaining to their experiences in writing and research. These questions included “What writing style do you use in your research? “ What is your current research about?” Other questions targeted their experience, if any, and opinion about the gender-gap and the unfair representation many women and people of color face in academic institutions and the workplace. These questions included: “Have you ever felt intimidated being in a STEM-related field as a woman?”, “Do you think men currently publish more than women?” and “Do you think men have the majority say in the first authorship?” The interviews were recorded through a phone, and participants were asked for permission prior to the interview. The interviews were then transcribed and after, the responses were analyzed to determine if there were any similarities or differences between the participants.

Results

The study was able to capture similarities and differences between the responses of the interviewees. While determining their writing experiences,

participants revealed they used mainly APA and MLA citation in their writing and also revealed that they faced difficulties prior to beginning their research. Their writings consist of various science communication such as manuscripts, grant proposals, conference writing, and letters of recommendation. Most of the participants indicated they enjoyed writing even though there were and still are situations of struggling with the translation of their raw collected data into a more understandable and cohesive format for the general audience.

The graduate participants explained that writing becomes more rigorous and demanding as one advances to graduate level. Participants, who indicated that English was not their first language, struggled with writing through their undergraduate experience. One participant stated that it is a struggle for her to put all her thoughts and ideas together in one paper. Additionally, they indicated the constant struggle in writing and communicating their research in a more understandable style. However, all of the participants recognized the importance of writing in the STEM field and felt open to changes in their writing. Most of the participants felt the feedback and track changes they receive either from their professors or colleagues are very helpful and supportive of their research. They expressed that writing is a necessary tool in order to communicate discoveries and findings to the general audience.

Graduate students who expressed difficulties writing scientifically, stated they would lean towards the writing boot camps that are offered for

graduate students to help them advance their writing skills. Overall, they felt these boot camps helped them significantly strengthen their writing skills and prevent bias.

Most of the graduate participants perceived their graduate program as supportive and their colleagues as positive and forward-thinking individuals. They did not feel any sense of a competitive environment in contrast to other institutions' graduate programs. However, when it came down to publication, most of the participants found that men publish and receive more recognition for their research than women. Also, they recognized the difficulty for women and people of color to receive higher professor positions, which can ultimately result in holding tenure, in the STEM field. Most agreed there are inequalities needing to be addressed within the STEM field between men, women, and people of color.

There was a general agreement of the impact authorship has on women and people of color in STEM. One participant felt men have an advantage in publishing since more than often men are taken more "seriously". This negatively affects the experiences of women and people of color as they have to prove their authority and intelligence to others. In her personal experience one participant felt the group of men she was working with would occasionally overstate their contribution in the project in order to receive main authorship recognition that they felt deserved. In addition, another participant stated there is "more likelihood to get into a top-tier

journal if the first author is a male and more citation if the author is a male", providing a glimpse of how impactful it is to have a male contributor.

Nonetheless, most of the participants expressed working well with their peers or colleagues regardless of gender. One graduate participant had the opposite experience working with men, however, in her current position at this school, she has not experienced that. The majority of participants felt that the University of California, Merced was very inclusive and diverse and is what helps STEM majors like them feel less intimidated and more welcomed.

A number of participants indicated the gender discrepancy in their classrooms, particularly in their chemistry and physics lecture classes. Participants, who had more males in their classroom, felt they were not taken seriously and had to prove themselves to their male colleagues by having to work harder to be recognized and be at the same level. One participant felt that men become surprised when she understood the class material quickly. Moreover, many of the participants felt that males perceive them as delicate beings, not fit to handle the difficulties that come from being in a STEM related field. In addition, some felt it is strenuous to connect or have discussions with their male classmates due to fear of asking "stupid" questions. However, a majority felt proud for being a minority in STEM and feel that the gender roles help motivated them to stop the negative stigma.

Throughout the interviews, it appeared that all, but one participant had an advisor or mentor that was a woman looking oversee their research.

When asked how they felt overall working with a woman, a majority felt thankful and appreciative that their advisor was a woman as they seemed to be more patient and understanding of their work compared to men. This demonstrated participants were more comfortable and less stressed with a female professor overseeing their work. Additionally, many agreed they were allowed to conduct their research with less restrictrictions and in a more independent and freelance manner. Through analyzing the results, it was concluded that the participants' research experience would have been different for them if their professor or mentor were a male.

Discussion

The results from the interviews determined that in order to make academic institutions, workplaces, and scientific journals more inclusive and equal, representation changes must occur. Participants acknowledged the fact that UC Merced is extremely diverse and inclusive, which is usually not observed in older and more established universities. For that reason, the participants' experience in research was positively impacted and shaped due to what UC Merced stands for. Not only is the student body diverse, the faculty hired to teach and conduct research are as well. This university provides equal representation and opportunities without taking into account race or gender. Diversity and inclusivity are necessary in order to end the gender-gap within the STEM fields. Therefore, the University of California,

Merced was used as a model example for improving the gender-gap and equal representation.

Although, the majority of the participants have not experienced any discrepancies between men and women at the University of California, Merced, they do feel that there are certain discrepancies between men and women in the field of STEM in other institutions. There are less opportunities for women and people of color when it came to conducting research. These two groups are given less responsibility and lower positions in research even though they have the required qualifications. In the past, women were not allowed in laboratories because the environment was deemed “dangerous and not suited for a woman.” While, people of color were not allowed due to strict segregation laws. Once segregation laws were removed, people of color were allowed in labs, however, only had limited access to certain areas of the laboratory, while their white colleagues had full access. This access limitation was implemented on women as well.

The importance of writing was clearly expressed by all the participants, whether they enjoyed it or not. Writing is a source of communication between the researcher and the audience. However, the writing must be presented in a way for an audience, whom may not be science affiliated, to clearly understand. The ability for researchers to present their research in a cohesive and simple manner demonstrates an important skill in science. This skill takes time to achieve, yet without this skill, researchers cannot fully establish themselves in the science community.

In addition, scientists cannot fully share their relevance and ideas of their research without knowing how to properly communicate it to a broad audience. Therefore, in order to be successful, scientists must master communication regardless of their career path or field of study. Researchers communicate their findings through publishing their research in a scientific journal. Improving their writing skills is critical as they continue to advance in their education and potentially publish an experimental report or manuscript.

However, all participants acknowledged the discrepancies when it came to publishing among men, women, and people of color. Women publish significantly less than men and account for fewer than 30% of the first authorship as opposed to men who represent more than 70% (2). With less research published, women have a harder time applying for positions in their field that require some sort of recognized research. People of color publish significantly less than their white counterparts, due to an unfair process when it comes to approval of publishing. There are fewer funding grants for research proposals awarded to people of color. An applicant’s background can influence whether their proposal is accepted or rejected. Funding decisions have the tendency to favor applicants with similar backgrounds of those who are approving their grant application. Those on the judging panel are predominantly white men. The success rate in approval of grant applications for minority groups is found to be 10% to 25% below the rate achieved by white applicants (3).

Fortunately, at this university, none of the participants have personally faced these discrepancies when it comes to first authorship. UC Merced provides equal opportunity for all its student body, regardless of ethnicity and gender. Because of this, the participants do not experience the unfairness when it comes to contribution in research. Unfortunately, many universities and workplaces do not uphold similar ideas. Women and people of color are not taken seriously by their white male colleagues when it comes to pitching ideas for a research article. Men take advantage of their high position by intimidating and questioning women's work.

As a result, women feel unappreciated and hesitate in asking for first authorship. Allowing women to express their ideas without judgment or being questioned can allow for their ideas to be published in a scientific article and ultimately be given the opportunity of authorship. The diverse and inclusive faculty at UC Merced has shaped the research experience for all of the participants. The diverse faculty has created an equal opportunity for women and people of color to conduct research and instruct at this university. Unfortunately, this does not hold true for most academic institutions and workplaces. Women and people of color are less likely to be hired for high position jobs, that would ultimately lead to tenure.

However, gender or ethnicity is not a determining factor in this university. All the participants' advisors or primary investigators (PIs) were women, which is not commonly observed in most research-based universities. Having a mentor that is from a similar background clearly

creates a better relationship between mentor and mentee. These participants felt comfortable working with their advisors/PIs because the respect they received while working in research. In addition, their advisors/PIs were patient and helpful throughout their research experience. It was evident that the way advisors/PIs treat their undergraduate and graduate researchers created a positive impact in the participants' experiences.

Even though none of the participants indicated experiencing gender discrimination while attending and conducting research at UC Merced, they acknowledged that women and people of color in other universities and in the workplace do experience it. They understand the struggles these two groups face when applying for positions in the STEM field and overall the challenges being in the STEM field. UC Merced has strict conduct rules about discrimination based off of one's gender and ethnicity. If these rules are broken, there are serious consequences for whoever committed the discrimination. There have been cases about discrimination against gender and ethnicity in other universities and the workplaces. These universities must implement strict rules of conduct in order to avoid women being discriminated and feeling excluded in the laboratory. Additionally, these strict rules will punish any individual who breaks them.

This study proved to be successful in interviewing participants in collecting their observations, opinions, experiences about their writing, research, and the exclusion of underrepresented groups in science, such as

women and people of color here at the University of California, Merced. The main focus of this study was on gender inequality, racial bias, and discrimination placed upon the scholarly, peer review process as it is the base of scientific publishing. Moreover, it is to keep in mind that gender disparity continues to be an ongoing real issue that is still being pushed aside. We hope that the results of this study help University of California, Merced to set an example and be a model for other institutions, workplaces, and science, technology, engineering, and mathematics (STEM) fields in order to create a more diverse and inclusive environment.

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