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On Gender Disparity in Engineering Academia

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Abstract— **This Research, Full Paper presents a study that sheds some light on the gender related disparities that women face in engineering academia. STEM has always been a male dominated field with, for example, less than ten percent women in electrical engineering jobs, a figure that continues in academia, but dwindles when it comes to senior academic positions at universities. Though studies have uncovered that such disparities exist in academia, little is known about difficulties that female engineering university teachers face in low- and middle-income countries in South Asia. In this study, twenty-five female (N=25) and eighteen male (N=18) university teachers from the electrical engineering and computer science departments of three different universities in Pakistan were interviewed, using a semi-structured interview methodology. The interviewees had between one and twenty five years of teaching experience, holding junior teaching positions, all the way to Professor. Interview questions were mainly related to job responsibilities, tasks assigned, authorities given to them and comparisons to male colleagues. Data collected was analyzed using phenomenological research techniques, with different meaning units listed and then clustered into seven common themes. Challenges related to gender disparity in academia were mainly reported by female participants. Only five of the women in this study had persevered despite challenges and had either improved or were in the process of improving their qualification. These were also the women that seemed more driven and claimed to have had more support from their family, home and from the workplace. The rest of the women were somewhat uncertain about their professional progress and preferred to remain in their 'comfort zone' i.e. at a lower rank and lesser salary. The importance of this study is in the fact that it highlights the problems that female academics face in a region of the world where such studies are few and far between. Though women university teachers in Asia and the Middle East could relate more to these problems, the insights gained from this study could benefit women in this profession in any part of the world.**

Keywords—gender disparity, gender challenges, engineering academia

I. INTRODUCTION

Gender disparity in academia has been a topic of study for more than a century. It is a globally known fact that female enrolment in engineering, technology and science programs is always low, less than twenty five percent in the sciences and less than 10 percent in engineering [1]. This underrepresentation of women in engineering is problematic on several levels. First off, the entire profession of engineering is missing out on potential talent; approximately half of the population (in any country) is seemingly less interested and chooses to stay away. This would reduce the talent, creativity and quality of the workforce in all of engineering. If this trend continues, women themselves will continue to miss out on yet another opportunity for a promising and rewarding career and financial independence.

The reasons for this disparity and lack of interest has also been a topic of interest for decades. Notions put forward by Horning [2] that this low representation was largely due their "lack of ability, interest, or both" is certainly no longer the case in most countries of the world where girls are taught math and science at elementary school level. Kanny et al [3] did a systemic review of 324 papers that were published over the course of forty years. This yielded five dominant metanarrative explanations for this lack of interest; individual background characteristics, structural barriers in kindergarten to grade-12 education, psychological factors, values and preferences, family influences and perceptions of STEM fields. Moreover, a study conducted by Reigle-Crumb and Morton [4] suggested that peers play an important role in whether girls should pursue STEM related fields. The results of their study showed that exposure to a larger percentage of male peers in the classroom who endorsed explicit gender/STEM stereotypes had a significantly negative impact on whether the girls later intended to go for engineering or computer science as a major. However, the results also showed that a larger percentage of confident female peers in the classroom had a positive effect on their intentions to later on pursue engineering.

Engineering academia like all other fields in academia, remains a male dominated field. This dominance, like under representation has also been a popular topic of study for decades. According to Aisenberg and Harrington [5], female faculty in engineering face a 'double-blind' in which they have to first try to redefine the 'male' image of a professor and then also that of an engineer. All that while being surrounded by a cadre of male academics. According to the American Society of Engineering Education (ASEE) 2021 data [6], the percentage of female tenured/tenured track faculty in different engineering disciplines ranges from 12.2% to 26.7% for an average of 18.1%. Moreover, only 13.3% of full professors in engineering are female as compared to 24.3% female assistant professors. Table I shows the percentage of female tenured faculty by rank.

RANK	PERCENT
All Faculty	18.1%
Full Professor	13.3%
Associate Professor	20.6%
Assistant Professor	24.3%

Though this data collected by the ASEE is for universities in the United States, similar trends could be expected in other parts of the world. This raises three questions about women in engineering academia:

1) First about the number of women getting selected for engineering and technology faculty positions,

2) Second, about the number of women that are successful in advancing their careers all the way to full professor and

3) Third, about the validity and fairness of meritocracy in advancement in the field of academia in general.

Nielson [7] in his study addressed this gender gap in academic advancement in the sciences. The study focussed on whether women's 'high attrition rates' in STEM are because of structural and cultural barriers deep inside the academic system or due to individual traits like personal motivation, performance and merit. The study involved a cross-sectional bibliometric study and compared the citation and self-citation rates, source normalized impact per publication scores and collaborative patterns of 3293 male and female researchers at a university in Denmark. The results of this study raise some questions about how much valid are the individual-meritocratic explanations of the skewed gender distributions in academia.

Abramo et al. [8] conducted a study on the scientific performance of 3600 individuals. These individuals were professors in Italian and Norwegian universities and their publication output between 2011 and 2015 was analysed by using bibliometric indicators. The results of this study showed that there was a higher proportion of men amongst the top 10% performing scientists. Negligible difference (in gender) was found amongst the remaining 90% of the population.

A discriminatory response can be caused by explicit or implicit beliefs. While explicit beliefs are conscious and deliberate, implicit associations can be automatically activated. Such associations could cause one to discriminate without conscious intent [9, 10]. Certain implicit associations cause people to connect STEM with men instead of women. These can be measured using the Implicit Association Test (IAT) [11-13]. An individual's explicit belief can sometimes justify his implicit discrimination [14, 15] which would in turn, accentuate the effects of the implicit associations. When such people believe themselves to be truly objective, their gender discrimination would increase while making decisions [16]. Regner et al. [17] conducted a two year study on whether decision making committees that have implicit biases end up promoting less women when they themselves do not believe that gender biases exist. The committees were only reminded of the study in year one. It was found that the committee promoted less women in year two, when they were not reminded of the study compared to year one, when the study was actually announced. The study showed the importance of educating such selection committees about explicit and implicit biases in order to ensure a fair selection amongst both genders.

There have been very few noteworthy studies about such gender disparities and biases in engineering academia in South Asia. In low and middle income countries like Pakistan, women tend to be marginalized in all strata of the society, academia being no different. In developing countries, cultural norms and stigmas often go hand in hand with organizational policies. In most cases this results in further marginalization of female employees. Fakhr and Messenger [18] conducted a qualitative study that involved in-depth interviews with 16 female academics throughout Pakistan. Thematic analysis of the interviews showed that there were three main things that affected the development of their career; social and cultural experiences, their experience at the institutions that they worked for and their own coping strategies.

This paper presents a study that involved gathering qualitative data by interviewing 25 female and 20 male engineering teachers in three different universities in Pakistan. In addition, 18 male engineering teachers from the same universities were interviewed in order to compare the results. Phenomenological research methods were used to sort the data and draw conclusions. The importance of this study is in the fact that it touches upon a version of the 'story' of gender disparity in academia in a part of the world where few studies of this nature have been conducted. Female academics in all fields of study and all parts of the world would be able to relate to most of the findings of this study.

The rest of this paper is organized as follows. Section II outlines the phenomenological research methods that were used in this study. Section III explains the methodology used for the data collection and then explains the analysis in detail. Section IV discusses some important points, not mentioned in the data and Section V concludes the paper.

II. PHENOMENOLOGICAL RESEARCH METHODS

Phenomenological theory was first formed in the early 20th century by German philosopher Edmund Husserl. His followers at the universities of Munich and Gottingen later on expanded on his initial works, after which it eventually spread to the rest of the world [19]. Clark Moustakas [20] outlined phenomenological research methods in terms of both processes and methodology, which are briefly explained below:

A. Processes

- The first part of the process involves "Epoche", which is the concept of setting side all prejudgments about the topic of research and to start the interview/data collection with an unbiased and objective approach.

- Next, phenomenological reduction brings the concept of 'horizonalization', in which every statement and piece of information is given the same value.

- Then invariant qualities and themes are found by clustering the non-repetitive, non-overlapping constituents. The textural descriptions from each research participant are then integrated and eventually a composite or universal textural description is formed.

- The next step in the process is about 'imaginative' variation'. In this step, different possible meanings of the descriptions from different perspectives and different vantage points are used to construct a list of structural qualities of the experience.

- Finally, intuitively-reflectively the composite textural and structural descriptions are integrated in order to 'synthesize' the meaning and essence of the phenomenon of the experience.

B. Methodology

- First step in the methodology is the preparation before the collection of data. This involves formulating the questions to be asked, conducting a literature review in order to determine the nature of the study. A criteria for selection of participants is made, then contracts, consents, confidentialities, and commitments are made. Then instructions, guiding questions and topics are developed and given to the researcher for the interviews.

- Second step is the actual collection of data. This starts with the interviewer emotionally disengaging him/herself from the topic, also called "bracketing" in phenomenology. The purpose of the interviews is to collect qualitative data. These interviews should be candid/informal, in-depth with open-ended questions and should be guided by the topic of study at the same time.

- Third step involves organizing and analysing of the qualitative data in order to develop individual and eventually composite structural descriptions from which meanings and essences of the experience will be synthesized.

- The final step is to summarize and relate the findings of the study to the literature review, personal and professional outcomes, social meaning and relevance and then decide on future directions and goals.

III. THE STUDY

This study uses a methodology informed by phenomenological research methods that were described in section II and previous global studies on gender disparity in academia, referenced in Section I. Twenty five female university teachers from electrical engineering or computer science departments of three different universities in Pakistan were interviewed. The average female/male ratio (for faculty) in these particular departments in these universities was 10%. These teachers were aged 25 to 47, with mean age 33 and standard deviation 5. They had one to sixteen years of experience and carried the ranks of research associate, lecturer all the way to full professor.

In order to ascertain that any findings female participants reported were gender related and not a systemic problem characterizing all academics, 18 male faculty members from the same departments of these three universities were interviewed. These faculty members were aged between 26 and 52 years, mean age 36, standard deviation 7.6 and carried positions from Research Associate, Lecturer, all the way to Professor. Their years of experience ranged from one to twenty five years. In order to maintain clarity of the findings for both genders, the data obtained from male teachers has been analysed separately.

A. Data Collection

The interviews were semi-structured, in-depth and were conducted by women who themselves had an electrical engineering or computer science background. Each of them had more than five years of university teaching experience and could personally relate to the challenges faced by female faculty. Similarly, the male faculty members were interviewed by their male counter parts who also had at least five years of experience. The interviewees were (in sequence) asked six open-ended questions, each of which evoked a short discussion. The average time taken for each interview was 32 minutes. The content of these interview questions, though somewhat re-phrased each time according to the interviewer was as follows:

1. Describe your role/tasks/responsibilities/authorities of your job at the university. How similar or dissimilar would you say these roles are to other colleagues (male, female, senior faculty members etc.)?

2. Would you say that you face any challenges at work? Would you say that these challenges are faced by other colleagues in your department of the university?

3. Would you say that you face societal pressures at work, or from home, due to your work? How does this compare to your colleagues? How does this affect your job? How do you maintain a work/family balance?

4. Female faculty above the rank of Assistant Professor are few and far between. How would you explain that? Has this (lack of female role models/mentors in engineering academia) affected your motivation and encouragement at the workplace? For the male faculty, this question was modified as: Do faculty members (male or female) senior to you, play an encouraging and motivational role at the work place?

5. Do you strive to progress to Associate Professor, Full Professor or department head? How do you plan to achieve that? How long do you think it will take to happen? What factors do you think will determine your success?

6. In your opinion, what can be done in order to address and resolve the issues discussed today?

B. Findings & Analysis

The qualitative data collected from these interviews was analysed using phenomenological reduction, variation and synthesis that were explained in Section II. This analysis yielded seven key themes that are summarized in Table II.

Each of these themes is further explained and analysed in the rest of this subsection.

TABLE II.
KEY THEMES EXRACTED FROM DATA

1. Motivation (extrinsic and intrinsic)	5. Disparity in assignment of responsibilities
2. Pre-conceived notions (that men have about women and those that women have about themselves)	6. Social Stigmas
3. Leadership and management at the workplace	7. Family influence (both pressure and support)
4. Social relationship (with peers and superiors)	

1. Motivation (Extrinsic & Intrinsic):

Most of the women interviewed were low on motivation. They got little encouragement at the workplace, even less from home. Instead they felt some extra pressure to prove themselves at the workplace and finish the tasks assigned to them. It appeared that whatever intrinsic motivation they had seemed to have had been dampened by all the extrinsic pressure (negative motivation) that they were facing.

Of all the interviewees, only 25% seemed to have the motivation required to deal with the challenges faced by women in academia. During the interview, these women were visibly more driven and believed that it's up to them to 'make their way in the world' and were not expecting any easy handouts. They did share many of the complaints about male dominance, misogyny etc. and agreed that there are unfair pressures that women in this country have to deal with but also partly blamed some of their female colleagues for their own lack of motivation. Their motivation seemed purely intrinsic but upon further inquiry, it appeared that they also had support and motivation from home and in some cases, also from the workplace. Though these women should be lauded for their will-power and determination, it appears that extrinsic and intrinsic motivation are not mutually exclusive and one does have a direct effect on the other. This relationship has been studied in [22, 23].

2. Pre-conceived Notions (men about women and women about themselves):

Almost all the respondents complained about how they are in a perpetual struggle against the classic stereotypes attached to women in this society. They are not only the 'fairer sex' but also considered the 'weaker and less capable sex'. Such (pre-conceived) notions that men have about women start from early childhood while growing up in a patriarchal, male dominated society where sons are often given preference and more value over daughters. Female engineering students at universities, being in a minority (usually less than 10% of the class), continue to face these notions that their male peers were brought up with e.g. girls cant code, girls are bad at math, girls are afraid of doing practical work etc. In some cases the women themselves start to believe in these pre-conceived 'short-comings' and automatically (sometimes happily)

assume a secondary role to the men while working in the labs or while working in group projects.

The effects of the above mentioned pre-conceived notions continue in professional life. Certain tasks are considered 'not suitable' for women, by both men and women in the society. Examples of such tasks could be anything from extra or co-curricular activities, out of town or off-campus assignments, duties assigned in the evening or anything that requires leading a team. Some interviewees also mentioned how certain men simply do not like to take orders from a woman, making their job yet more difficult. Most department heads are usually reluctant to assign women such duties and quite often, women also express their general unwillingness towards them. This 'unwillingness' from both sides only adds to these pre-conceived notions, often (wrongfully) deeming female university teachers in this part of the world as 'less useful' than the men.

The notion of men being the designated 'bread-winner' of the family plays an indirect role in the motivation and ambition of female university teachers. Some just dismiss the need to 'go the extra mile' because they believe that it's not their job in the society to work hard and provide financial support to the family, that's the man's job. These women are happy that they can supplement the household income, a few even said that they are working just to 'make some extra pocket money' for themselves.

3. Leadership and Management:

At least half of the problems faced by the participants in this study can be traced back to the leadership of the organization and how the department is being managed. A large portion of the complaints noted in this study came from the faculty members from one department of one university. Within this department, there was a considerable overlapping/similarity in the complaints mentioned by the participants. Many of these were about all the 'social lobbying' their male colleagues were able to do with the department heads in order to get preferential treatment, particularly in the assignment of teaching courses for the semester and other administrative tasks. The women that mentioned they also believed that men were able to get away with certain degree of 'incompetence' due to this camaraderie that they had developed with the management.

The level of dissatisfaction and the homogeneity of complaints of the female faculty seemed to reflect on the quality and vision of the leadership in the department that they worked for. Female engineering faculty in another department that was interviewed, made no such complaints and also believed that they were given the same treatment as their male colleagues.

4. Social Relationships (with peers and superiors)

Since most of their peers were male, the participants found it difficult to create and maintain social and professional relationships with them. Most of the women ended up making social relationships with other women in their department. In larger departments, 'factions' of such social groups even formed. They were also hesitant to network with other engineering professionals outside of their organization for fear of negative reactions or labels by their male peers. The

participants also believed that this 'distance' that they often felt with their superiors also reflected in their salaries and annual appraisals.

When asked about the idea of female superiors or department heads, some welcomed the idea as they believed that their male superiors were not sympathetic enough or were not able to fully understand their problems. In such cases, they would have felt more comfortable discussing everything with a woman. That being said, most of the participants thought of it as something that was too good to be true and was unlikely to become common in the near future. This was a nod towards the concept of the 'glass ceiling' for professional working women. Others believed that it would make little difference as the female superior or 'boss' would probably remain selfish, only take care of herself and would not do much to help the other women in her department.

5. Disparity in Assignment of Responsibilities:

Here the participants described a clear difference in the assignment of non-teaching responsibilities. Women were almost never made the head of any committee or panel and were often made members of a committee just for the sake or female representation and had to report to a male colleague that they believed was less competent for the job than they were. Some women also believed that their male peers were able to lobby their way into getting assigned courses, teaching schedules and admin tasks of their choice while the women were assigned courses, time slots and tasks that were left over. These women also complained that while working in a group or task force, they would end up being assigned all the menial and 'boring' tasks that the men didn't want to do themselves. On the other hand, some women also said that they saw no such disparity in their department. These women even believed that as a courtesy, they were given preferential treatment in their choice of teaching schedule.

Some women believed they were usually given tasks that required less authority i.e. tasks that involve less pressure to handle, the underlying assumption here is that the women would be less resilient and less assertive. Most of the participants were offended by this assumption and believed that they could handle pressure just as well as their male peers and should be given an equal chance for the assignment of such tasks, instead of being pre-judged due to their gender.

6. Social Stigmas

Social stigmas exist in every society of the world. In every case, these stigmas are formed due to the disapproval and discrimination against individuals or a group of people that according to the perception of other members of the society have certain characteristics that distinguish them from the majority. Social stigmas can be about gender, race, sexual orientation, disabilities, age, health, material wealth etc. [24, 25].

Our participants, both explicitly and implicitly described the various social stigmas that they were constantly afraid of being labelled with, while on the job. Pakistan as a developing country, has a wide spectrum of social classes and societal cultures. A confident and ambitious professional working woman would command respect and admiration in some sectors of the society while at the same time, would be given multiple stigmatic labels in other sectors. The faculty members that were interviewed in this study hailed from all kinds of backgrounds. Some were independent women, with little or no limitations attached by their families while others came from more conservative backgrounds and wore a veil or a head scarf to work and had to seek special permission from their father or husband before being allowed to work as a university teacher. Ironically, women from both of these contrasting family backgrounds would live and work with the same kind of fear of being labelled with some kind of stigma from any sector of the society.

Many of our participants, talked about this constant worry about social stigmas. They admitted that it often held them back from taking certain positive steps and initiatives at the workplace, lest people 'might talk'. They would also be careful while interacting with their male colleagues and department heads for the same reason. On the other end, some of the women said that they were comfortable chatting with their male colleagues whether in faculty offices or even enjoying friendly banter over a cup of tea in the faculty dining area. They simply believed in the fact that 'people will always talk', so why let it bother you?

The flip side of these social stigmas involves the male superiors or department heads. According to the women, they would sometimes be extra careful in dealing with female faculty and would often avoid being lenient for fear of being labelled or 'stigmatized' as e.g. a 'female sympathizer'. This would cause yet another level of disparity for female university teachers.

7. Family Influence (Pressure and Support):

Family influence, as suggested by the heading, is a double-edged sword, according to the participants that were interviewed. Some participants claimed complete and unconditional support from their families and also received equal support at the workplace. These were the women that were actively able to improve their qualification and research profile and (with a conspicuously positive attitude) were aspiring to get promoted to Professor one day. These women had their responsibilities towards their 'in-laws' and children sorted out, claimed a near-perfect work/family balance and were able to give enough time to their teaching and research activities at the university.

For 90% our participants, creating this work/family balance had not been easy, almost impossible for some. In Pakistan it is common for men to continue to live with their parents even after they get married, in some kind of a joint family system. Such a system, though seemingly odd to other cultures is a widely prevalent and successful form of living in South Asia. This form of living has multiple benefits e.g. the family functions together as a larger unit with each sub unit supporting each other while sharing the available resources. The downside of this joint family system, especially for the women is that they would be facing some kind of 24/7 monitoring/scrutiny from their husbands family. Amongst our participants, the women who lived in joint family systems complained about always having to live up to the expectations of a family that were living under the same roof. They said that a woman in our society is expected to be a good wife, a good daughter in-law, a good mother and is also expected to cook for the family and manage the house. Some said that their family helped with taking care of her children while she was

at work, while others found it difficult to give due time to their jobs after having kids. In these circumstances, some of our participants were just happy that they had some kind of university job and said it was impossible to give any extra time to conduct research and improve their qualifications. They also believed that the men has much less 'family oriented' expectations to live up to and were able to spend more time or their careers, which according to them, was their primary responsibility anyway.

C. Male Faculty

The data collected from the male faculty that were interviewed had little to do with gender disparity and was more to do with their disagreement with the university policies and other systemic problems. Since the focus of this paper is on gender disparity in academia, it was deemed unnecessary to organize the data into different themes. The responses to each of the six questions however, have been summarized in this subsection.

In response to the first question, the male faculty described their teaching workload along with any assigned administrative duties. There were little or no complaints about teaching load and they all believed that it was given according to their rank and fourteen of the eighteen claimed that the assignment of courses was according to their choice. When asked about disparity in administrative tasks, only four complained that they were given more duties than their male peers. When asked about their female peers, the common initial response was that they only have a few female colleagues and know little about them or their duties. They still believed that female faculty 'get away' with less admin tasks simply because less tasks are assigned to them.

The second question, regarding challenges at work, got quite a uniform response. Each male faculty member mostly complained about the policies set by the university management and how they affected their daily routine. For example, they all wanted more flexible working hours, better annual increments and also believed that they should get annual bonuses etc. They all acknowledged that women would have their own set of challenges in this environment but were almost clueless to what these might be.

While answering the third question about societal pressures, the common complaint was about expectations of being the breadwinner of the family and how difficult it was to maintain and run a household in this economy. Six of the faculty interviewed were living in a joint family system mentioned in Section III, ten percent of which were the sole earner for the entire household. These men reported the most pressure, mainly due to their number of dependents. Maintaining a work/family balance didn't seem to be a problem for sixteen of the men, they believed that providing for the family was good enough. The remaining two though desired to spend more time with their families, they still felt content that they were working hard and supporting them.

Since there were plenty (at least 20%) of male faculty members above the rank of Assistant Professor in all three universities, it seemed counter-intuitive to ask question four in the same way so it was modified, hoping to extract more useful data. They were instead asked if faculty members senior (whether male or female) to them played any positive role in their motivation and morale at the workplace. About seventeen of the interviewees said that their seniors were always encouraging and were willing to guide/motivate them when needed and eleven felt inspired by them.

In response to question five, all male interviewees gave the same positive answer. They all believed that improving their qualification and progressing was not a matter of choice, but a necessity. All the male faculty interviewed were actively working on improving their professional profile in different ways. While thirteen of the eighteen believed that they could progress faster if the department 'lightened' their workload, the remaining five were satisfied with the support they were given.

The response to question six had a large overlap with the response to question one. Each male faculty member gave their opinions and disagreements with certain policies in their respective departments at their universities. They had a holistic view about their challenges and roles in the society and seemed to have accepted them. The suggestions they had were quite generic. For example, they all believed that they deserved more compensation, more incentives, perks and support from the university. They further admitted that if given all these things, 80% of their complaints and challenges would go away.

IV. DISCUSSION

Though this study focusses on disparity, the overall situation in Pakistan for female university teachers in engineering is not all grim. The fact that women (the interviewers and peers to the interviewees) were able to conduct and publish this research is a testament to the fact that they do enjoy support and motivation from the society and the workplace. One of the participants in this study is in fact a full professor and is also running for department head at her university. She continues (without relent) to strive for this position that she believes she deserves, despite the pressure and negativity that she faces from her male colleagues.

When asked about what their future plans are and what they were doing to improve their qualifications, those women that were themselves motivated and had support from family and the workplace were in some cases working as hard as their male peers, striving to get promoted. The rest of the women were somewhat uncertain about their professional progress and preferred to remain in their 'comfort zone' i.e. at a lower rank and lesser salary. For them, taking the 'next step' required too much sacrifice that was seemingly impossible to make in the foreseeable future. For the men however, this was simply not an option. All the eighteen were striving to improve on their qualification in hope to secure a better salary or position in their respective organization.

Surprisingly, sexual harassment was almost absent from the list of challenges and disparities faced by female (and male) engineering academics in this study. Each participant was explicitly asked about this topic and whether she had faced sexual harassment in any form. Only one woman amongst the 25 participants said that she had faced some mild form of harassment and was able to handle it on her own, without feeling the need to report it.

When asked about what could be done to improve on the issues discussed during the interview, the participants gave some interesting and useful suggestions:

- Though the government of Pakistan has passed laws on sexual harassment, laws against other forms of harassment like professional intimidation should also be considered.
- The society at large needs to change its mindset and women need to be more vocal about it.
- There is a huge disconnect between the upper, middle and lower classes of the society. Such 'disconnects' are not conducive for a society to grow and improve since neither class has a clear understanding of each other.
- Many participants believe that it falls upon the higher management of the university to monitor, check and balance such disparities.
- All the participants agreed that they would feel more comfortable addressing their concerns and complaints if a more formal and structured method was built into the system. They all knew that sending a note or email to the upper management was always an option, but still believed that a more systemic and ingrained complaint mechanism for example, as part of the university HR policy would make it 'easier' for them.

This study focused on female and male engineering university teachers in Pakistan. The same methodology could be expanded to spawn several comparative studies. For example, with engineering university teachers in other countries, like the United Kingdom. The study could also be conducted on university teachers in faculties where the ratio of men to women is not balanced such as Arts and Social Sciences.

The data collected during this study shows that female academics indeed do have to face more challenges than their male colleagues and a large part of these challenges have to do with gender disparity. This is evident by both the volume and 'intensity' of the issues reported by the women as compared to the men. A general observation made by the interviewers was that the women were eager and enthusiastic to talk about their issues while the men were relatively relaxed and casual about them.

V. CONCLUSION

This paper presented the methodology and findings of a study conducted on female and male university teachers working in engineering or computer science in Pakistan. The methodology was based on phenomenological research methods and used a semi-structured and in-depth interview approach for the collection of qualitative data. Based on the analysis of the findings, we can conclude that even though the society in this part of the world still has a long way to go in the course of promoting gender equality in engineering academia, women university teachers continue to persevere and make their place in an industry that is globally dominated by men. While some are still struggling to compete with their male counterparts, others, despite all societal pressures have successfully achieved the highest rank and level that academics can enjoy.

REFERENCES

[1] K. Buse, "Women's under-representation in Engineering and Computing: Fresh perspectives on a complex problem," Frontiers in Psych., vol. 9, pp. 1–4, April 2018.

[2] L. S. Horning, "Women in science and engineering," Technology Review, vol. 87, pp. 30-41, 1984.

[3] M. A. Kanny, L. J. Sax, T. A. Riggers-Piehl, "Ivestigating Forty Years Of STEM Research: How Explanations For The Gender Gap Have Evolved Over Time," Journal of Women and Minorities in Science and Engineering, vol. 20, no. 2, pp. 127-148, 2014.

[4] C. Riegle-Crumb, K. Morton, "Gendered expectations: Examining how peers shape female students' intent to pursue STEM fields," Frontiers in Psych., vol. 8, 2017.

[5] N. Aisenberg and M. Harrington, Women of Academe. Amherst: University of Massachusetts Press, 1988.

[6] American Society of Engineering Education (ASEE) 2021 data

https://ira.asee.org/wp-content/uploads/2021/02/Engineering-by-the-Numbers-FINAL-2021.pdf

[7] M. W. Nielson, R. Nicole, "Gender inequality and research performance: moving beyond individual-meritocratic explanations of academic advancement," Studies in Higher Education, 2015.

[8] G. Abramo, D. W. Aksnes, C. A. D'Angelo, "Gender differences in research performance within andbetween countries: Italy vs Norway," Journal of Infometrics, vol. 15, 2021.

[9] P. G. Devine, "Stereotypes and prejudice: their automatic and controlled components," J. Pers. Soc. Psychol. vol. 56, pp. 5–18, 1989.

[10] P. G. Devine, et al. "A gender bias habit-breaking intervention led to increased hiring of female faculty in STEMM departments," J. Exp. Soc. Psychol. vol. 73, pp. 211–215, 2017.

[11] A. G. Greenwald, D. E. McGhee, J. L. K. Schwarz, "Measuring individual differences in implicit cognition: the implicit association test," J. Pers. Soc. Psychol. vol. 74, pp. 1464–1480, 1998.

[12] A. G. Greenwald, T. A. Poehlman, E. L. Uhlmann, M. R. Banaji, "Understanding and using the implicit association test: III. Meta-analysis of predictive validity," J. Pers. Soc. Psychol. vol. 97, pp. 17–41, 2009.

[13] B. A. Nosek, et al. "National differences in gender–science stereotypes predict national sex differences in science and math achievement," Proc. Natl Acad. Sci. USA, no. 106, pp. 10593–10597, 2009.

[14] R. H. Fazio and M. A. Olson, Dual-Process Theories of the Social Mind, pp. 155–172, Guilford Press, 2014.

[15] C. S. Crandall, and A. A. Eshleman, "Justification–suppression model of the expression and experience of prejudice," Psychol. Bull. vol. 129, pp. 414–446, 2003.

[16] E. L. Uhlmann, and G. L. Cohen, "I think it, therefore it's true": effects of self-perceived objectivity on hiring discrimination," Organ. Behav. Hum. Decis. Process, vol. 104, pp. 207–223, 2007.

[17] I. Régner, C. Thinus-Blanc, A. Netter, T. Schmader and P. Huguet, "Committees with implicit biases promote fewer women when they do not believe gender bias exists," Nature Human Behavior, vol. 3, pp. 1171–1179, 2019.

[18] Z. Fakhr and H. Messenger, "Gender inequality and academic freedom in Pakistani higher education," Innov. in High. Edu. Teach. and Learn., vol. 31, pp. 67–84, 2020.

[19] D. Zahavi, Husserl's Phenomenology, Stanford, Stanford University Press, 2003.

[20] C. .Moustakas, Phenomenologocal Research Methods, Thousand Oaks California, Sage Publications, 1994.

[21] M. Van Manen, Researching lived experience: human science for an action sensitive pedagogy, Albany, NY: The State University of New York, 1990.

[22] C. Fischer, C. P. Malycha and E. Schafmann, "The influence of intrinsic motivation and synergistic extrinsic motivators on creativity and innovation," Front. In Psych., vol. 10, 2019.

[23] B. Kuvaas, R. Buch, A. Weibel, A. Dysvik, C. G.L. Nerstad, "Do intrinsic and extrinsic motivation relate differently to employee outcomes?," Journal of Econ. Psych., volume 61, pp. 244-258, 2017.

[24] E. Goffman, Stigma: Notes on the management of a spoiled identity. New York, NY, Simon & Schuster, 1963.

[25] B. Major, L. T. O'Brien, "The social psychology of stigma," Ann. Rev. of Psych., vol. 56, pp. 393-421, 2004.