

**WOMEN IN SCIENCE: A CASE STUDY OF MUSLIM WOMEN  
RESEARCH SCHOLARS AT A CENTRAL UNIVERSITY**

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in partial fulfillment of the degree of

**MASTER OF PHILOSOPHY**

In

**SOCIOLOGY**

By

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### CERTIFICATE

This is to certify that dissertation entitled “**Women in Science: A Case Study of Muslim Women Research Scholars at a Central University**” submitted by **Najla P V** bearing Reg. No. **19SSHL10** in partial fulfillment of the requirements for the award of Master of Philosophy in Sociology is a bonafide work carried out by her under my supervision and guidance.

The dissertation has not been submitted previously in part or in full to this or any other University or Institution for the award of any degree or diploma.

Nagaraju Gundemeda

Signature of the Supervisor

//Countersigned//

Head of the Department

Dean of the School

## **DECLARATION**

I, **Najla P V**, hereby declare that this Dissertation entitled, “**Women in Science: A Case Study of Muslim Women Research Scholars at a Central University**”, submitted by me under the guidance and supervision of Professor **Dr. Nagaraju Gundemeda** is a bonafide research work. I also declare that it has not been submitted previously in part or in full to this University or any other University or Institution for the award of any degree or diploma.

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## Chapter 1

### INTRODUCTION

Education is an important social institution that contributes to the transformation of society in many respects. Emile Durkheim defined education as a social fact, and for each society, education is a means of securing the necessary conditions of its own existence in the children. So, education is emphasized when it comes to even the existential questions of society. Education is also a process by which an individual learns the things necessary to fit him into the social life of his community. It denotes the importance of education in a human being who is a social animal. It can be said that it is the process of education that helps a human being become or transform into a social animal. Education is an important factor that also leads to social mobility, thus stimulating the research interests of social scientists in general and sociologists in particular.

There are several studies on education from different perspectives and theoretical frameworks. From these studies, we could understand that, in any society, education was not received equally by all people. In other words, educational chances were not equal for all. Instead, various criteria form the basis of discrimination and differences in the distribution of education among people. Gender differences are one of them. We can find women deprived of education or denied access to education in any society. When we look at women in terms of education, they suffer from a lack of access and support throughout. The patriarchal and "patrifocal"<sup>1</sup> social setup led to this, and these systems promote male students rather than female students in education. Even though female students manage to access educational institutions, surviving inside them is difficult for many reasons. To a great extent, the universalization of education has solved the issue of access to education, especially for women. However, there are still many unresolved problems inside the education system, including gender inequality practices that adversely affect female students the most.

The sociology of education deals with the various aspects of education. Its philosophical and sociological subjects reflect ideologies, curricula, and pedagogical techniques for instilling and

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<sup>1</sup> Patrifocality in the Indian family structure is a system that 'gives precedence to men over women - sons over daughters, fathers over mothers, husbands over wives, and so on'. See Lalita Subrahmanyam (1995) article Patrifocality and the entry of women in to science for details.

managing knowledge and the social reproduction of personalities and cultures. In practice, the sociology of education is mainly concerned with schooling, especially the mass schooling systems of modern industrial societies, including the expansion of higher, further, adult, and continuing education (Scott, 2014).

In this research, we have considered science education and research, which is again associated with inequalities within the education system. Science emerged as a field of knowledge with the scientific revolution in the global west and later became popular and widely accepted in the entire world. But the same problem of inequality mentioned above also exists in science education and research.

There are numerous reasons for this disparity in female education, particularly among Muslim women. These elements combined create a severe barrier to women's advancement in general and Muslim women's success in particular. When we look at the prior research for these reasons, we find regional and religious differences in higher education. Muslim's access to higher education is non-existent in rural areas, although Muslim women have higher opportunities than Muslim males in urban areas. The greatest hindrance to improving women's educational standing is deeply established patriarchal practices and ideals. Other factors include a lack of funding, inadequate transportation, employment in traditional jobs that do not require a higher degree, family background, and so on (Amin, 2015).

Apart from this broad range of issues, we should also consider how people in our country feel about women's higher education. People believe that higher education is more suitable for boys than girls. Zoya Hasan and Ritu Menon (2004)<sup>2</sup>, in their book on the Education of Muslim women in India, highlighted the inherent patriarchal biases against girls' education. In some cases, educated Muslim women have ignorant spouses who prevent them from pursuing higher education. A highly educated girl is also regarded as undesirable for marriage. As a result of this attitude toward education, it is extremely difficult for women to advance. In addition, we must accept that the situation has evolved in recent years. The marriage rates of college-educated women significantly improved, indicating that college has a marriage-market dimension. This

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<sup>2</sup> For more details refer books 'Unequal Citizens: A study of Muslim women in India', 'Educating Muslim Girls: A comparison of five Indian cities' and 'In a Minority: Essays on Muslim women in India' by Zoya Hassan and Ritu Menon.



shift in women's education from one that discourages marriage to one that encourages it demands more attention. However, in several countries, men are ambivalent, if not outright hostile, towards educated wives (Jacobs, 1996).

The Sachar Committee report (2006)<sup>3</sup>, highlight social, economic, and educational standing of the Muslim community in India. When it comes to the educational situation of women in India, we can learn from the Sachar committee report that in 2001, the literacy rate among Muslims was 59.1%, which was lower than the national average (64.8%), with the disparity being most significant in metropolitan areas. Muslims had a higher literacy rate than SCs and STs. According to the report, Muslims face a twofold disadvantage due to low levels of education mixed with poor quality education; their deprivation grows exponentially as education levels climb. The committee concluded that Muslims had not reaped the full benefits of state intervention and educational advancement. While the overall levels of education in India, as assessed by numerous indices, are still below generally accepted standards, the educational standing of the Muslim minority, in particular, is a source of significant concern, according to the findings of the study.

An examination of educational attainment trends over time shows that Muslims have made the lowest development despite the general change in educational status. The proportion of Muslims who are poorest in the fields with the best job prospects is especially concerning. This has major long-term repercussions for the community's socio-economic empowerment. One of the leading causes of Muslims' limited engagement in higher education is their much lower accomplishment level in their secondary education.

The basic and important subject that we deal with in this study is gender disparity in the educational system. Let's take a look at how gender disparities affect people's educational achievements. In some parts of the educational system, gender disparity is more prevalent than in others. Some studies have found gender disparities at three levels: access to higher education, college experiences, and outcomes. The study found that women do well in terms of access but suffer much in terms of the college experience and outcome. Gender inequality in higher

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<sup>3</sup> Sachar Committee is a seven-member High Level Committee, chaired by Justice Rajindar Sachar constituted as per the order of the Prime Minister to prepare a report on the social, economic and educational status of the Muslim community in India.

education should be explained in a way that distinguishes between different components of education and explains both the settings in which women have achieved parity and those in which they continue to fall behind.

Higher education is more expensive therefore gender disparities are more visible in higher education. We may see more than one concept come together to explain an event at times. The analysis of gender-related issues within the educational system with class can be seen here. However, there are several drawbacks to this type of study. Taking the help of class reproduction to make sense of gender inequality raises its own set of issues. Because these two types of inequality have fundamentally distinct relationships with the educational system, the parallel between class and gender fails. People's social positions are disadvantaged due to their lack of educational advancement. Even though class inequality can be connected to a lack of education, gender inequality in income can still haunt those with better educational qualifications.

When we look at the socio-political circumstances in western countries women have better educational opportunities when compared to our country. Studies have found that the following factors have helped to improve the status of women in higher education in the United States: The decentralized structure of higher education includes both private and public institutions, as well as special colleges for women. There existed a social space for the independent political mobilization of women that enabled them to establish schools for women. Also, women succeeded in bringing in the ideology of individual opportunity to justify their choices in higher education. While we can adapt the concept of specialized colleges for women to the Indian situation or certain traditional Muslim countries, the very idea of separate schools based on gender may limit girls' access.

When there aren't enough girls' schools, or when the distance to schools does matter, it raises questions and concerns about safety, and parents worry about the unavailability of their daughters for homely chores, which can also affect the girl's education. As a result, we can see how the Muslim preference for same-gender teachers decreases the number of work prospects for women. They care more about supporting boys' education than girls, who traditionally hold the majority of elementary teaching roles. On the other hand, in some Muslim nations, the motivation given to women to become doctors stems from the idea of same-sex doctors. It has

created more opportunities for women physicians. This tale of women in general and Muslim women in particular entering the medical field in India is a different one. If colleges offer a non-discriminatory education to young men and women, the issue of gender inequality would be resolved by the issue of access. On the other hand, women and men have quite different experiences in college and have very different outcomes.

Women's underrepresentation in science and engineering has got a lot of attention (Brush 1991; Yarrison-Rice 1995). The majority of these studies address specific initiatives to promote women's achievement or focus on individual difficulties such as psychological hurdles or a lack of social support. However, other studies link math and scientific challenges to broader educational and societal trends (Jacobs, 1996).

### **Conceptual Framework**

In this research, the education system is analyzed from a feminist theoretical perspective. Feminism (feminist theory) is a social movement combining theory with political practice that seeks to achieve equality between men and women. The feminist methodology is based on research methods that are either directed at the elimination of unconscious sexist bias in research. It also examines the male perspective and double standards taken for granted, or to the replacement of supposedly objective structured interviews and quantitative analysis by more reflexive and interactive unstructured interviews and a method of writing sociology that is said to allow the subjects to speak for themselves (Scott, 2014).

The feminist understanding of education puts forward that one of the main agendas of education is to maintain gender inequalities and thus reproduce and reinforce the patriarchal social system. Feminist scholars list out certain ways in which this is done, including gendered roles, gendered language, sexist curriculum, gendered subjects, gendered classrooms, sexual harassment, and so on in educational institutions. Feminist studies on education attempted to highlight the discrimination that women face in many areas of education. It includes access to education, various gendered practices, and so on. The education system as a whole, in a variety of forms, hinders the educational and intellectual development of women, which deteriorates the quality and productive outcome of women's education.

The feminist viewpoint raises specific fundamental questions such as why there are so few women in science and why science is so male-dominated, what barriers women face in entering and surviving in the science field, and why male occupations and intellectual fields have higher status than those of women (Haack, 1992).

Studies on global higher education from a feminist viewpoint have claimed that the shifts have not been in the direction of greater gender or social fairness. Generations of culturally and socially diverse women got involved in higher education nationally and worldwide as students, professors, and researchers as higher education expanded to meet changing global economic requirements. There was an explosion of materials, writings, and books as feminist ideas multiplied around various social theories. Rather than the existing (David, 2010) political forms of personalized learning, new critical pedagogies (Youdell 2006) arose from feminist and personal views. While an increasing number of women worldwide now have access to some restricted forms of education, women's standing in relation to men remains subservient, as Morley and Lugg (2009) indicate in their international feminist studies. They also mention that gender was left out of their research, which focused solely on higher education enrolments or access rather than academic success or achievements inside higher education. Now that gender equality has been established, the question of how to engage young and disadvantaged males in higher education has arisen.

The goal of "narrowing the gender gap" in higher education is aimed to secure male access and achievement rather than female equality in participation and achievement. According to some research studies, girls outperform boys in terms of academic achievement, regardless of socioeconomic status, and are more likely to pursue further education. They saw a photo of students who were "aiming higher" and had high hopes of attending university. On the other hand, their subject selections were gendered, classed, and influenced by strong ethnic patterns. It's not only about recognizing gender; it's about how gender and feminist ideas contribute to lowering socioeconomic and ethnic inequities, all while adhering to ethical standards that cherish and respect the contributions of people from all walks of life (David, 2010).

Even though there is a growing consensus that more women should enter the scientific field as scientists and researchers, still the number of males outnumbered females as natural and social scientists worldwide. Society has its own structures to systematically keep women from activities

that benefit them, such as professions and research. Society also has its own ways of trapping women in activities that impose a disproportionately burden them, such as housework and waitressing. The fact is that there are grounds for dividing benefits and costs even though there are people in society. The exclusion of women from certain activities and their concentration on others deprived them of the benefits and left them with only burdens.

The rationale behind the argument that more women should enter science is to make the pursuit of truth in research more robust. Otherwise, science may miss out on the unique perspective of women in search of this truth. Women working in science, not as lab assistants but as senior investigators, provide an outstanding contribution to the finding of truth, which is required for science to achieve its aim and that no one but women can provide. The inclusion of women in science can end the major criticism science faces that the truth is partial as it only reflects the male perspective as the research is carried out mainly by men. The truth can be made complete using the cognitive and intellectual skills or interests of women, which are different from those of men. It will enable them to carry out research that can discover new data and also give its explanations.

Thus women scientists' perspectives are innovative and critical. Lorraine Code (1981), a philosopher and feminist theorist, comes to the same conclusion, arguing that if men and women's cognitive skills differ due to biological variations, the knower's sex is epistemologically significant. Still, if cognitive sex differences result from unequal socialisation, the knower's sex is unimportant in principle. The Code also claims that cognitive sexual differences are mostly socialised rather than being natural. Women's significant engagement with science will help reduce or end the male domination of science reflected in its content, showing that women are being left out of science. It is often maintained that what is necessary, rather than more women, is political power. Women will lack acceptance and recognition in science unless they possess power. Otherwise, it is hopeless to dream about women being included in scientific fields where people with power exist (Soble, 1983).

Different theoretical concepts can be related to this proposed study. The concept of power can be used to understand the relationship between students and faculty. In educational institutions, a major process is a constant interaction between the faculties and students and between the students themselves. Academic output is also the result of these kinds of relations and

interactions. Identity theories in education talk about the engagement of social identity with education and its outcomes. It tries to address why some groups of people are less engaged and advantaged in education than others.

Paulo Freire, who is well known for his critical pedagogy approach, explained through his work "Pedagogy of the oppressed" (1968), talks about the 'culture of silence' (Freire, 1968). According to Freire, unequal social relations create a "culture of silence" that teaches a negative, passive, and suppressed self-image in the oppressed. Learners must then develop a critical consciousness to recognize that this culture of silence is created to oppress. By analyzing the cultural attributes of the Muslim community through the research, we could also relate the research to Bourdieu. Pierre Bourdieu explains cultural capital as a form of capital that is convertible, under certain conditions, into economic capital and may be institutionalized in the form of educational qualification.

### **The rationale of the Topic**

First of all, the research can help us know about the current status of the phenomenon being studied. Decades ago, various research studies and government surveys conducted about the various communities' educational status helped to frame reservation policies and further facts-based suggestions of different research made many important changes in the field of education. Its implementation has made incredible changes and transformations in the system of education as well as in the communities that benefited from it. Many scholars address the problem of access to education, whether it is primary, secondary, or higher education or research.

But what we need to look further into is the current circumstances and conditions of those who go to access education. Their problems, challenges, and advancements should be traced out properly; otherwise, the mere fulfillment of access to education will only remain as some numbers in the Gross Enrolment Ratio. It is necessary to investigate the current status of people who gained access to education after a long struggle; otherwise, their efforts will be futile. Number of suicides and institutional murders that happened in various premier educational institutions across the states is shocking. Knowing that most of the victims are from minority communities triggered me to carry on research in this area, that is, to explore the life experiences of students or scholars inside the campuses in the academic atmosphere. The competition and

importance of science in India as a field of knowledge is another factor that influenced me to do this research. Recent reports portray the intense struggles students and their entire families have to face to secure a seat in our country's science and technology fields.

Even though I am familiar with some previous studies on women in science, most of these studies are based on foreign experience. I couldn't find many studies on the same from an Indian perspective. And I couldn't find any specific literature on Muslim women researching science, which further stimulated my research interest in this topic. Because it is clear that women aren't a homogenous category and each category is different from the other in many respects, they also need special consideration.

This is the background from which this particular research sets out its journey of investigation, and the major questions it tries to look at are as follows.

### **Research Question and Objectives**

“Whatever we may say, we don't in reality regard women as suitable for science careers” – C P Snow<sup>4</sup> (1993: 103), (Kumar, 2012).

This research largely addresses the question of inequality in the education system. More specifically, this research is about Muslim women research scholars at universities specializing in science subjects. Being a woman and being a Muslim simultaneously is like a double burden within the education system. Because women were denied access to education for a long time, Muslims are the minority community in the Indian context and are backward in many ways, including education. A minority community can be defined as a social group that is oppressed or stigmatized based on racial, ethnic, biological, or other characteristics. Louise Wirth defines "a minority group" as a group of people who, because of their physical and cultural characteristics, are singled out from the others in the society in which they live for differential and unequal treatment and regard themselves as objects of collective discrimination (Scott, 2014).

Science is said to be a hard and tough subject to study, and the masculine character assigned to it makes it more suitable for boys only. While we consider the top scientists in world history, we

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<sup>4</sup> C P Snow (15 October 1905- 1 July 1980) is an English novelist and physical chemist. He mentioned it in his lecture, 'The Rede Lecture, 1959.

couldn't see more than a very few women in it, like Marie Curie (1867-1934), a Nobel laureate<sup>5</sup>. The prestige of science is a significant thing to be considered here, and it goes to male students. Feminist research points to the gendered selection of subjects. This is a reflection of patriarchal society. They argue that society's socio-economical-political and cultural systems reflect in the policies and practices of the educational system. When we consider this point in more detail, we can understand those female students refuse to select math, science, and technology as certain studies opine. Girls' subjects are of lower status and market value. Science, technology, and maths are thus more popular with male students. Science remains gender biased in its practices and styles, which repeatedly reinforces its gendered selection.

Anyhow, access to education is only one aspect of it. Still, we need to look at it in detail to understand how far science as an intellectual space includes women in its practices and methods. The science that is celebrated for being rational but at the same time critiqued for such discriminatory practices is a kind of irony. As a result, this study aims to investigate the experiences of female Muslim students, their challenges and problems, it also analyses the current state of science education and research at the university and the role of religious aspects, will be given prime concern, along with other socio-economic-political and cultural factors in mediating the educational opportunities for Muslim women students.

The primary objectives of this study are:

- *To understand the sociological significance of Muslim women in higher education in general and science research in particular,*
- *To investigate Muslim female scholars' motivations for pursuing scientific research and*
- *To analyze the universal issues and unique challenges Muslim women research scholars face both within the lab and outside of it while pursuing their doctoral studies.*

## **Methodology**

As there is skewed literature specifically on Muslim women in science education, it is important to fill the intellectual space in the area of sociology of higher education with special reference to

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<sup>5</sup> Marie Curie was a polish and naturalized – French physicist and chemist. She conducted pioneering research on radioactivity. She was the first person to win two Nobel Prizes. She won it in Physics and Chemistry.



Muslim women. The previous studies examined and established the trajectory of the development of women and Muslim women in science. The qualitative research method is deployed in this study. Five Muslim women research scholars, specializing in science, from various life science departments in the university were selected. In-depth interviews were conducted to understand their problems, current status, and the issues and challenges they face while pursuing their doctoral studies.

An interview is a social interaction that transfers information from the interviewee to the interviewer or researcher. Interviews may be personal, conducted face-to-face, or telephonic, or may be conducted at a distance through a postal, email, or online questionnaire. In this research, I have tried personal, face-to-face interviews. Due to the pandemic situation, I also used telephone interviews and online platforms to reach out to the study's respondents. The interviews are conducted based on the "convenient sampling". A convenience sampling method is a non-probability sampling technique where the sample is taken from a group of people who are easy to contact or reach. The socio-economic-political and cultural details of the sample students were also collected and analyzed to meet the objectives.

As the research has to explore the respondents' personal experiences and academic experiences, in-depth interviews are the best method. Because while having in-depth interviews after establishing a good rapport with the respondent, we can get the response in detail, taking as much time as needed. Even though we may not always finish it in a single stretch and spend hours and days with a single respondent, in-depth interviews can still be justified as they can enrich the first-hand data. As the in-depth interview method consumes a lot of time compared to many other methods with a single respondent, keeping the number of respondents low will be helpful to the timely completion of the research. Along with this, another reason for selecting five respondents for in-depth interviews is the willingness of respondents. The first stage of these interviews, rapport building, was done well. The respondents cooperated with the interviews very well. They were in a position to inform us of their convenient date, time, and place so that the interviews could be conducted and completed step-by-step.

## **Reflections from the Field**

Field work is one of the vital parts of any research that can give the researcher first-hand data that constitutes a significant share of the study's uniqueness. Data collection for any study involves talking to people or asking them questions about their activities and views, sometimes including the systematic observation of their behaviour. Field work ranges from large-scale surveys to small-scale case studies. In this research, I used a case study technique in which only a few respondents were interviewed. The interviews are in-depth to collect as much information as possible for meeting the objectives.

By the time I started the interviews with the Muslim women research scholars who are specialized in various branches of biological science came the widespread pandemic, and Corona and the entire world went into lockdown as a preventive and safety measure to reduce the spread of the virus and thus the pandemic. During the lockdown days, as I was at home, I couldn't continue my field work for a long time. So, I finished the literature review part of the research. Later, I thought about conducting interviews through online platforms and carrying on interviews. But it was not as easy as I thought because online platforms or telephone interviews were not the best choices for in-depth interviews. The respondents only gave very precise answers to the questions over the phone, and the network instability and issues added fuel to the fire. As a result, I decided to continue the fieldwork once the lockdown was lifted and until I could conduct direct interviews.

So once I got back to the campus and tried to contact the respondents to continue the interviews, most of them were stuck with their work and couldn't give me enough time to have an in-depth interview. They worked on their lab work even late at night and on weekends. Before the pandemic and lockdown period, I visited the laboratories of some of my respondents. Sometimes, I had to go to their hostels, laboratories, or even invite myself to their houses. But some were worried about any kind of harm that I may have mistakenly caused, as there were a lot of chemicals and equipment made of glass. So, they didn't allow me to come to their lab. There were other reasons as well. Some were concerned that it would disturb their fellow scholars in the lab, while others were concerned that the supervisor would become enraged if they discovered that a stranger was roaming around the lab.

And some of them were also worried about my safety because many chemical substances are hazardous to health, and I was unaware of the expensive equipment in the lab, which they couldn't take the risk of causing any damage. Their lab environment was a new experience for me to observe. Some of my samples were all alone in the lab. The lab had a lot of equipment, chemicals, and a lot more, which I didn't have any idea. They were air-conditioned halls. And the samples sometimes said it affected their health badly. Still, they couldn't help it because much of the equipment, chemicals, or samples they have in their lab need particular temperature levels to sustain and survive. So rather than the scholars, these things were given emphasis in the lab setup. They were advanced, with many facilities to carry out their research. And the fellow researchers of my respondents enquired about why I was there in their lab and what I was doing there.

I was a stranger to fellow researchers, so it was kind of an embarrassment for me as well. But as I had already made a kind of rapport with my samples before I went for the in-depth interviews, the interviews went well. I explained my research, the topic, and a brief background of the study to convince them and hint at what I wanted to know from them. As it was an in-depth interview, I let my respondents talk freely after giving certain instructions and a framework to talk through my questions without cutting their talk in the middle or interrupting much. Sometimes they just talked and deviated from the questions, which took longer to complete the interview.

Another exciting experience during the fieldwork is that the fellow male research scholars came to me when they learned that I am conducting interviews and told me that they also had problems and that their interviews should also be considered. I told them that I need to be more specific and focused as I don't have the luxury of time now, so I will be considering them when I go for further research to expand the domain of research further. I met some of my respondents from their hostels; they offered me tea, juice, snacks, and so on and treated me well. Even though they talked to me so openly about their family and experiences in the academic space, they were initially afraid to open up as they didn't want any trouble because of these interviews. I promised them to keep the identity details confidential and any other sensitive things they shared. So, I somehow convinced them about their safety, and later, they opened up and talked so freely.

During and after the lockdown period, even though I somehow managed to continue the research, especially field work, there were a lot of limitations. Entry to departments for outsiders

was strictly restricted, especially to the laboratories. And personal face-to-face interactions were also in trouble because everyone was concerned about the safety issues amid the pandemic. So, I missed many of my respondents as they were only available on the campus for their work as they were busy with their work and they didn't want to take the risk of having some outsider, more or less a stranger, get into their hostels or homes because of the pandemic situation. And the online or telephonic data collection was not that satisfactory and detailed, but in the case of some respondents, I was left with no other options.

Another significant experience is how my identity played a role in the field work. My identity can be seen both as an outsider and an insider in the field. As a Muslim woman research scholar, it helped me build a rapport with the respondents easily and quickly. The respondents felt it more comfortable to share their experiences with me, especially the experiences they faced as women and Muslims. As I am from a social science background, I also became an outsider in the field. There were specific difficulties in grasping the experiences and ideas that were mainly related to the science fields of the respondents. It affected the time and place of the interviews conducted because I had no access to certain places exclusive to the respondents and had to adjust with time in order to match their comfort.

This outsider experience can also be one of the research limitations. Although India has had a very vibrant women's movement, its interface with the scientific community or engagement with issues related to women in science has been relatively recent. Female scientists have yet to develop feminist discourses. This has resulted in either women scientists attempting to study women's issues within a limited framework or sociologists and women's studies scholars independently conducting studies with an inadequate understanding of the complexity of scientific institutions.

## **Chapter Plan**

This dissertation consists of five chapters in total. This introductory chapter is followed by the second chapter titled "Feminist Critique of Science and Science Research," which primarily reviews previous studies on women in science education and career. It is divided broadly into two parts. The first part is a literature review about women in science in foreign countries, and the second is about women in science in India. The third chapter, titled "Women Scholars in

Science at the University," explains the university's statistical data regarding women scholars. It also provides a detailed personal profile of each respondent in the study, with certain analysis. The fourth chapter is titled "Life in the Laboratory: Understanding the Academic and Personal Lives of Muslim Women Research Scholars in Science." It is based on the personal experiences shared by the respondents. It analyses the universal problems women face in science and the unique challenges Muslim women face in science. The final and fifth chapters present the findings and concluding remarks of the research.

### **Summary**

This chapter gave an introduction to the research. The introductory part provides the background and departure point of the study. It explains how the research question is set by the entanglement of the concepts of education, gender, and minority identity. The research question was established in the following session of the chapter, and the theoretical perspective by which the research question is addressed is also discussed alongside. The methodology part has given details about the rationale behind the method used to collect data and the selection of respondents for the research. Furthermore, it also provides the researcher with experience in the field.

## **Chapter 2**

### **FEMINIST CRITIQUE OF SCIENCE AND SCIENCE RESEARCH**

#### **Introduction**

This chapter will broadly discuss the history of women scientists from a global perspective in general and an Indian perspective in particular. This chapter is divided into two parts. The first section will focus on the experiences of foreign (western) women in science education and research. The second part will deal with women in science research in India. The chapter will examine the significant reasons behind the low number of women in science education and research from various feminist perspectives such as liberal, radical, socialist, and identity. It tries to look at women's statistical and qualitative status in scientific research. This also includes a feminist critique of science and scientific research. It puts forward multiple feminist epistemological frameworks to analyze the research question. Women are not a homogenous group, and when there are fundamental changes in each group of women, their problems and challenges also change. Thus, we can't understand or analyze the issues with a single theoretical framework and perspective. Looking into the experience of the west is significant when it comes to science, as science has emerged as a field of knowledge in the west. And the west is also known for its pride in greater civilized people, the promotion of equality, and individual freedom with less discrimination, especially that of gender. So, first of all, let's look at how Western society treats women generally and specifically women in science education and research.

#### **Feminisms and Education**

If we look hard enough, feminist historians have discovered that every age has had its share of women whining about their male peers. There has been a clear feminist presence in history from the early years through the Middle Ages to the current period. On the other hand, different feminisms have highlighted different parts of women's resistance against oppressive forces. To demonstrate the diversity within feminism and the shared dedication to women's growth, we might categorize each feminism according to its ideological background. While researching this, several academics discovered three feminist ideas that had the most significant impact on education. They are termed as follows (Arnot, Weiner, 1987):

Liberal feminism focused on equal rights in education. The importance of patriarchal relationships is emphasized by radical feminism. The prime concerns of Marxist/ socialist feminism were class, race, and gender, as well as their structures and ideologies. Liberal feminism is the most widely accepted of all feminisms, and it stands for the free will of women to choose their roles in any field, just like men. It called for a ban on anything and everything that hinders equality of rights and opportunities. It asserted that women should be free to exercise their social, political, and educational roles. Because it was believed that providing equal education could encourage any individual to develop their potential. To attain its goals, liberal feminism chose democratic reforms over revolutionary changes, which was a distinguishing feature of liberal feminism. Betty Friedan is a critical liberal feminist whose 1963 publication, *The Feminine Mystique*, has been popularly regarded as signaling the beginnings.

The idea of "patriarchy," which initially meant "the reign of the father," was employed by radical feminism to analyze the principles that underpin women's subjugation. However, it was changed to depict men's historical supremacy over women, which was considered the model for all other oppressions and was required for their perpetuation. Patriarchy was described by Schulamith Firestone (1970) as male dominance over women's reproduction. When we consider how Humm (1989: 159) puts it, "feminists needed a phrase by which the whole of repressive and exploitative interactions that impact women could be represented," it is evident that the concept of patriarchy is critical to feminism. Distinct feminist discourses, on the other hand, create different versions of patriarchy. The "universal oppression of women" is an important presupposition of radical feminism.

Women are the oppressed class if all men oppress them, even if there is some debate regarding how patriarchal relations are founded and maintained. Another assumption is that women must go through a process of women-centered education in order to be aware of the repercussions of male dominance (or re-education). It's also known as "awareness-raising," and it's a method of disseminating information about the female experience that was once used as a form of education for women who lacked a thorough understanding of the subject. Women desired to learn the truth about how they felt and saw their lives and what had been done to them and how they functioned in the world. Radical feminism created a new language and discourse framework focused on liberty and collectivism and challenged modern sexual relations and politics.

As a critique and extension of the feminist mission, women in Marxist and socialist groups attacked radical and liberal feminism. Juliet Mitchell began to establish a feminist viewpoint that advocated changes outside traditional Marxist economic and social policies, despite being chastised by her male colleagues for being ideologically incorrect. These included changes in production women's place in the labor market; reproduction-sexual divisions within the family; sexuality-in the views of women as primarily sexual beings and sex objects; and socialization-how young people were reared and educated (Mitchell, 1971). As capitalism is based on patriarchal labour division, patriarchy is discussed here in terms of its materialism and historical foundations. Black feminism puts forward a significant challenge to radical feminism. Black feminism criticized radical feminism for being a "White Women's Movement" with an oppressive nature, along with criticism of white patriarchal society for oppressing black women on many grounds. Black feminism argued that radical feminism was built on economic and social differences between races, and that made their attempt to articulate an authentic, all-encompassing women's experience invalid.

The idea of universal sisterhood was shattered by the rising black feminist presence. Black feminists contest that feminism might be meaningless if it ignores racism. For black women, the concept of patriarchy has a particular meaning. Identity politics was pioneered by black feminists, who organized around distinct oppressions, allowing differences and equality to become themes within feminist politics. In this regard, black feminism is defined as a self-conscious struggle that empowers women and men to actualize a humanist view of the community (Hill Collins, 1990: 39).

Gender stereotypes about appropriate roles for women in South Africa have prevented women from entering fields of study such as math, engineering, science, technology, and information technology and occupying key jobs in these industries. This had a negative impact on black women in particular. For this trend to continue is not only counterproductive, but it is also harmful to women. The under-representation of women in science careers can be traced back to their educational status. A shortage of female scientists nowadays is due to their low educational numbers. Domestic training was emphasized for African women in particular. In high school, girls were often aggressively discouraged from studying science or considering a career in science. This discouragement continued at the university level, where a lack of money and



support in career counseling and mentorship significantly lowered the number of women pursuing careers in science and technology.

The preponderance of male scientific teachers contributes to a deficit in ideal role models for young, aspiring female scientists. For young females, science's masculine image is also discouraging. Even female teachers favour boys, expecting them to perform better than girls. Even if women can battle for and enter science careers, theorists contend that their involvement in a system that is fundamentally designed to oppress women would not lessen their difficulties. They point out that where women have been "included," they tend to be at the bottom of the employment ladder, where the classic glass ceiling prevents them from progressing. In order to understand the position of women anywhere, it is necessary to examine the ideologies, stereotypes, and societal norms that dictate what roles are appropriate for women. This means that socially constructed norms and ideas about the appropriate roles for women in the labour market and in society, or about the physical unsuitability of women for science, act as major barriers to women in science. To remove the masculinization of science and overcome some of the misconceptions about women, popular media must be used to promote an image of science and technology as an appealing and accessible area for women (Martineau, 1998).

One of feminism's most important goals is rejecting male-defined knowledge and behaviour. Inspired by Simon De Beauvoir's legacy, French feminist writer Cixous asserts that man is the self, and women are his "other," and that women exist in a man's world on his terms. She says that women must write themselves out of the world that males have built for them by putting the unthinkable into words and using women's own unique forms of writing.

Other feminisms have emerged as feminism has become more divided and identity politics has become more possible. Here, we'll look at one of them pertinent to this study: Muslim feminism, which sees women's liberation as more dangerous to Islam and more broadly based than in the West (Weinar, 1994).

Feminism is a relatively new idea in Islam. In the burgeoning western literature on "women and Islam," this term was first used in the 1990s. Some Muslim women from the middle and higher classes began to speak out about the unequal construction of gender and the dominance of males over females in the second half of the nineteenth century. They were adamant about women and

men being treated equally in the public domain and accepting the complementarity of roles in the family. However, these were expressed more or less individually and specifically. They didn't raise any issues with the patriarchal system in general. The feminist expression can be divided into three distinct waves. The first wave's personal writings conveying gender consciousness, such as poems, short tales, novels, memoirs, journalistic articles, essays, and scholarly works. The second wave conveys "everyday activism," which comprises personal advancements in daily life, the formation of social service organizations, educational breakthroughs, and the development of new professions. The third wave is evident and more comfortable, coordinated movement activism.

In the late 19<sup>th</sup> century, one of the central issues of the feminist movement was female education. The promotion of female education was the first step in removing the bonds stipulated by traditional views of *purdah*. It contributed to transforming the very idea of *purdah*, that symbolic curtain that separates the worlds of men and women (Samiuddin & Khanam, n.d.).

According to Gita Chadha (1997), it is critical to recognize that the post-modernist attack on enlightened reason as a concept of transcendental and universal truth does not limit feminist critiques of rationality and modern science. This is not to say that the post-modernist trend in science philosophy and epistemology has considerably impacted the discussion over how to build a feminist connection with science—its methodology, metaphysics, and ideology. The debate, like the relationship, is a tumultuous and fiery affair. Broadly the feminist critiques of science, developed in the 'second-wave feminism', saw clearly that modern science and technology served as means for women's domination and not their liberation. Diverging from the People's Science Movement and opening itself to accusations of being 'anti-science' and 'anti-progress', the feminist movement made its way toward "an understanding of science and its practice which could go beyond the propagation of rational thought" [Rose, 1986].

Modern science and enlightenment do not have to be the only options and allies for attaining the key edge needed in social change campaigns. Feminists must not only establish a pertinent critique of contemporary science but also tread the path into traditions in order to search for instruments that are hopefully less 'universal' and more 'local' than enlightenment reason, which is also a product of a certain period of European history (Chadha, 1997).

The following section, we will look at the existing studies on women in science from a sociological perspective. Both the foreign experience of women in science and the Indian experiences of women in science are considered for review.

### **Women in Science Research: A Sociological Review**

Several studies have been conducted on the education of women so far from various perspectives. From a sociological standpoint, we look at those studies focused on women in science education and research.

In 1976, the American Association for the Advancement of Sciences hosted a symposium on minority women scientists. Its primary conclusions were that a twin bind of racial and sexual discrimination had kept minority women out from the scientific mainstream. It voiced worry about the hundreds of thousands of minority groups, particularly minority women, who have been excluded or "tracked" out of the pool of available scientific and technological talent. The conferees agreed that if the pool of minority female scientists is to be expanded, strong leadership at the highest levels of government and corporate institutions is required. In the academic, government, and corporate sectors, more women and minorities, particularly minority women, must be promoted to scientific management positions. Affirmative action in education and training, as well as recruiting and promotion, should be vigorously pursued. Minority women scientists were also opposed to systems that they saw as punishing and rarely rewarding them for participating in activities aimed at addressing the exclusion of minorities and/or women from training and professions. It underlined the impact of stereotyping on minority women's professional choices (Quick Hall et al., 1976) .

We have already mentioned how gender discrimination is practiced in the education system. Gendered language in academia is one of them. In this way, we can see an injustice done to women scientists. It may lower the aspirations of young women, exacerbating the situation. Women scientists, whose biographies are included in the volume but whose existence is openly denied in the title, are offended by the title of the widely used reference work, "American Men of Science." On the surface, the name suggests that scientists are men. This destructive suggestion reaches many minds since these volumes are used by the scientific community and are also

available in libraries, for students, and for various other purposes. The title may have been suitable when first published, but that is no longer the case (Goldstein, 1971).

According to a survey executed in Canada, found that science and engineering are primarily male-dominated occupations. This occurs in a society dedicated to ensuring equal access to education and opportunity for all of its residents, as well as defending their right to physical and psychological security. At the bottom of the scientific ladder, women scientists prevail. Only a few women are found in the higher echelons of society, where policies and choices about research funding and direction are determined. The evidence is overwhelming that science is "firmly located in the hands of a white, Western, bourgeois, (compulsorily heterosexual) man" in terms of both power and knowledge. Life experiences and men's and women's distinct procreational obligations and skills continue to significantly impact our expectations of women in general and women scientists in particular. According to the data, women are virtually excluded from some science jobs, while they are ghettoized and segregated in others. Women scientists are concentrated in the biological sciences, social sciences, and humanities, according to the field.

They are extremely rare, as they have always been in mathematics, physics, chemistry, and engineering. Women scientists are found in the greatest numbers at the level of practicing technology, with specified jobs requiring little scientific or technical skill, and they are poorly compensated. In the theoretical fields of any science, however, men, on the other hand, predominate. They dominate policy-making bodies and government committees and numerous guilds of basic and applied scientists, frequently in an exclusive capacity. Regardless of how the quantitative and qualitative data are analyzed, the general results about women in science, engineering, and technology are the same. Science is an intellectual activity that women do not share equally with men.

When we examine certain works on education from a feminist perspective, we can see that the scholars are focusing on the need for women to enter administrative and policy-making positions because they have found a lack of consideration and attention paid to the issues and problems faced by women in the educational field. They propose this as a response to the ignorance of women's issues in education to a considerable extent. Feminist involvement in education is crucial. Western knowledge, according to feminist theorists, is built on masculine experiences and hence cannot be regarded as the entirety of the human experience. Without the women's

perspective, it is only a partial and incomplete picture. They also seek to reform science, both epistemologically and practically, and attract more women to the field (Harding, 1992).

Regarding Muslim women in science education and research, Farkhonda Hassan's work is crucial since it provides us with context. She highlights the notable Muslim contributions to science (for example, Al-Khwarizmi (born in 825 A.D.) invented algebra (an Arabic word), from which the word algorithm is derived; Ibn al-Haytham (born in 1039 A.D.) wrote the laws of reflection and refraction of light and expounded the principles of inertia; and Ibn Sina (born in 980 A.D.) wrote the laws of reflection and refraction of light). She went on to say that even though new educational institutions are established in Muslim countries, especially to foster the growth of science and technology, there is also gender discrimination, which is a reflection of society and culture. It has become a hurdle for women's progress in education.

Some people blame these limitations on Islamic doctrines, although this is incorrect. The acquisition of knowledge is a bounden duty of each Muslim from the cradle to the grave, according to the preaching of Muhammad, the Prophet of Islam, and "the pursuit of knowledge and science is mandatory upon every Muslim man and woman." The Quran (the Muslim Holy Book) exhorts Muslims to study nature, ponder, and make the best use of reason to search for the ultimate truth in one-eighth of its verses (750 verses). Women are born and brought up in a patriarchal society with strict gender roles and expectations that restrict them from doing many things that actually benefit women. Due to factors such as gender stereotyping, misconceptions about science and technology that encourage boys more than girls to study science, and the failure of the curricula to connect science and technology to women's lives, there already exists a bias in the educational framework which pushes women away from science and technology and pulls them towards the arts and humanities. There are other difficulties, such as balancing domestic and family responsibilities with a professional career.

Even though science is advancing in research every day, scientific groups are notoriously reluctant to change to be inclusive of women. Women struggle to re-enter scientific careers after a break they may have taken for their family or children. A survey of female scientists in various fields reveals that higher-ranking science and technology institutions are less inclusive of women in prominent positions. A few Muslim female scientists serve on national and international committees to promote science and technology at national and global levels (Hassan, 2000).

Racism, gender bias, and third-world marginalization are examined with regard to the variables influencing African women pursuing graduate degrees in the sciences at western universities. It also examines how conscious these women are of the impact of these influences on their studies. It also looks at how these women dealt with the pressures of family and marriage. While most countries have made progress for women in science, there is still a gender imbalance and a loss of women in scientific-related employment. Women have lower enrolment in science courses, notably outside of the biological sciences, lower success levels, and more negative views about science disciplines in Third World nations. Studies of women's labour market participation in scientific jobs also show that, while women are hired, they are underrepresented in certain high-level talent pools.

In most colleges women make up less than one-third of the faculty is an example. In the academic hierarchy, they are substantially less likely than males to hold top-level managerial or professorial jobs. Because "female" is a gender category connected with traditional societal and familial demands, it's crucial to examine how women who pursue higher education respond to specific demands placed on them by their families and society. When it comes to the elements that contribute to this kind of circumstance, the dominant argument has been that men have preferential access to resource distribution. This contributes to the perpetuation of sex-based and gender-based systems of inequality in science. Women of colour have additional challenges in getting access to and advancement in scientific disciplines due to discrimination based on race, ethnicity, and class. Although these women are educated and competent, their capacity to pursue graduate studies or professional or scientific positions is questioned because they are of a certain race. They also mentioned the impact of ethnicity and gender on each other (Beoku-Betts, 2004).

According to a study that looked into why women have a more challenging time pursuing research careers than men, the subject has been thoroughly researched in highly industrialized countries. Still there is very little evidence from less developed places. Gender disparities in human qualities, professional resources, and the organizational settings under which research is performed were modest or non-existent in the study, which looked at gender differences in a range of individual, social, and organizational aspects. This research also claims that combining educational and research localism increases the women's risk of having limited professional

networks. Gender inequalities in developing world systems may be based on systemic weaknesses in the acquiring social rather than material resources.

According to the study, the major implication is that in the near future, educational policies for development should focus on international possibilities for women. Academic achievement differences are linked to traditional familial roles in a specific way. Traditional role occupancy includes caretaking responsibilities, making long-term travel problematic. This is most evident in higher training possibilities, particularly when studying overseas or outside the state. Women have fewer opportunities to create social and professional contacts with outside institutions than men because they are less likely to train or travel outside their local area than men, which is an advantage in academia. Assume that via education and professional travel, male scientists' professional networks become more externally oriented. In that situation, their sources of knowledge and research direction may become more worldwide and less local than women's (Campion & Shrum, 2004a).

Feminist epistemologies of science have become an accepted element of feminist study in increasingly complicated analyses. However, they have yet to impact on natural science scholarship or curricula significantly. Women's studies and biology, chemistry, and, least of all, physics departments are not natural allies in the minds of feminists and scientists alike. Instead, these groups are arbitrarily and institutionally segregated in ways that inhibit any type of interaction, resulting in more misunderstanding and hatred than collaboration. Those who recognize the need to bridge feminism and the natural sciences, allowing these disciplines to become mutually informed and having scientists who are feminists and feminists who are scientists, frequently focus on the concerns of women scientists rather than ways to shape the training of all scientists. Few people think about the collaborative role that women's studies and natural science departments can play in building new curricular paradigms for the sciences as scientists and educators attempt to reshape the nature of science education. In short, there is still minimal interaction between science practitioners and feminist educators, many of whom urge a more balanced, inclusive, and contextual approach to science (Bartsch, 2000)

## **Underrepresentation of women in STEM**

A study in the US puts forward why women continue to be underrepresented in most science, technology, engineering, and mathematics (STEM) professions. Most studies believe that complex and deeply ingrained concepts of gender roles, societal expectations, self-confidence, and how men and women judge success and deal with failure are at least part of the solution. There's also the issue of a lack of role models. According to a study, the gender imbalance in STEM fields is not natural. Instead, the variance is mostly due to differences in culture and learning environments, and how our society cultivates talents and interests. Women with STEM degrees are also less likely than their male counterparts to work in STEM employment, even though women in STEM positions earn 33% more than women in non-STEM jobs. According to the Census Bureau, about three out of four STEM professionals are men. More importantly, attracting more women into STEM will require them to be more comfortable with failure and even receive lower grades.

According to researchers, fewer students receive top scores in science and engineering courses, and the prospect of receiving worse grades is one of the reasons women drop out of those subjects. Men, on the other hand, are less likely to define themselves by their grades. Women also mistrust their own talents, and it's not so much that they aren't performing well as they don't believe they are. Experts note that women who pursue STEM careers face various challenges, ranging from being neglected by academics to being ignored by managers, in meetings, or when it's time for promotions, which discourages them. According to Yale researchers (Fletcher, 2015), many scientists—physicists, biologists, and chemists—were more likely to view young male colleagues favorably than women with the same skills.

In 1991, a study of female scientists in Japan revealed disturbing figures, such as the fact that there were only 40 female full professors in all of Japan's 495 universities' science faculties. Young female scientists in China are not as free to share their thoughts in the United States. They've been taught to keep to themselves and not communicate much. The lack of women in science in Japan concerns more than just a few women attempting to break into the field. According to some research studies, the Japanese government and business leaders are concerned about a potential scarcity of scientists and engineers due to a continual flow of scientifically qualified people into higher-paying jobs in business and finance. At various levels,



women are discouraged from pursuing a career in science; professors advise female students to obtain a job after graduation rather than pursue graduate school. On top of that, the negative pressure at home intensifies.

Many female scientists claim that once they start their profession, they face no discrimination in their research. They claim that they are only judged on the quality of their work, which makes the laboratory a more appealing profession than business, where social skills in a male-dominated sector are crucial. When women apply for administrative positions, it's a different story, which may explain why so few women who become lecturers advance to the university's professorial level. However, because only men are allowed to attend major national institutions, women are forced to attend minor colleges, resulting in a scarcity of high-quality science education. Greater emphasis on science in women's university curricula may help shift the perception of science as a topic acceptable for women to study. Recent studies have revealed a sharp fall in women's interest in science, necessitating such a shift (Myers, 1992).

### **Number of Scientific Publications by Women**

Publications are a vital element of any subject's research, and having one is the best way to leave your mark on the world. It is the most effective way to market research and makes it available to the academic community and the general public. Furthermore, publications play a significant role in promotion and tenure. According to several studies, women scientists write far fewer papers than men. The same amount was published by married women with and without children. Access to resources, teaching load, and hostility has been identified as contributory variables that diminish women's productivity. Science is a costly industry, and publications require a source of finance, laboratory space, graduate students, and other resources. Women did not have access to such resources in previous decades. Although the situation has improved significantly, there is still likely residual prejudice in grant allocation and access to other resources. Heavier teaching loads came from residual sex discrimination. If women are assigned a higher teaching load, as has been the case in the past, they will have less time for research and, as a result, no publications. Aggressiveness is another characteristic that comes into play.

Science can be a very contentious business. Any speaker at a scientific meeting is likely to be challenged, contradicted, or questioned uncomfortably. This intellectual and personal aggression

may cause female scientists to be more cautious and less likely to publish evidence that they aren't entirely confident. As a result, women devote more time reviewing data, repeating experiments, and revising articles. Many published works are attributed to reputation-building, which occurs when authors seek out every possible outlet for their work in order to improve their position. Women, on the other hand, are more likely to prepare a single paper rather than search for every possible combination of facts that might be published. Women are less likely to be overly speculative or publish inadequate facts, avoid agonistic confrontations and literature discussions, and territorial and engage in status-enhancing behaviours (Loehle, 1987).

### **Women Scientists in the Workforce**

Any education has a higher outcome and accomplishment if it leads to employment. One of the fundamental goals of education is to equip students to find work and, hence, a means of subsistence. It's not much different in science and engineering. Around 80% of women with a science or engineering degree are employed, but many work in fields unrelated to their fields. Most people who leave the workforce do so temporarily, and roughly half of them do not take a professional sabbatical, even if they have young children. Student status, highest degree level, parental status, children's age, and the subject of study are all factors that influence labour force participation. In several sectors, women have higher unemployment rates and poorer wages than men, and their work opportunities are limited. Women's engagement in science and technology could be improved with some policy changes, and better data is needed to track their progress (Vetter, 1979).

From now on, we have got an idea about women in science from a global and specifically western perspective, their problems and challenges being faced. Now let's examine the same for women in science in India. To understand women in science from the Indian perspective, we should first look at the importance of science in India.

### **The Importance of Science and Technology Education in India**

People in India place a higher value on scientific and engineering education than we believe. They are pushed into a situation where the applicants and their entire family must make significant sacrifices to gain admission to elite science and technology institutes. According to a survey based on IITs in India, the strain is unbearable, and the preparation is exhausting. As a

result, pupils as young as 14 are expected to begin the process, often miss out on the simple pleasures of youth. To achieve the aim, most people give up extracurricular activities, friendships, and all sorts of amusement. Many people realize that by the time they attain their goal, if they do, they have lost social skills, the ability to converse well with others (known today as "soft skills"), and, of course, some of their youth. To "help them focus," parents go to great lengths to separate their children from the outside world. Watching television, surfing the Internet, and attending social gatherings, sports, and hobbies are all pushed to the bottom of the priority list<sup>6</sup>. This news broadcast gives a clear yet powerful picture of India's commitment to science and technology. Let's look at the status of women in India's science and technology fields.

### **Women in STEM Education in India**

Women make up as much as 40 percent of the Indians who graduate with science, technology, engineering, and mathematics (STEM) degrees. However, it appears that neither the graduates nor the country benefits from it. According to the United Nations, women make up only 14 percent of India's 280,000 scientists, engineers, and technologists working in research and development institutes. Despite their efforts to empower women, this is the case. According to the UN,

"While the number of girls enrolling in science for higher education has increased in India, the number of women entering the workforce has not increased in the same proportion."

Women are a minority in science, accounting for approximately 30% of the field, and only 35% of STEM students are female. On the other hand, India is a contradiction in that it produces graduates but not researchers.

The gender wage gap is one of the main reasons for limited involvement. Despite their groundbreaking discoveries and achievements, the gender pay gap exists in science research, preventing women from moving as far in their professions. "Girls are frequently persuaded that they are not smart enough for STEM, or that males and men have a natural affinity for the field," the UN argued. According to the report, women write fewer research papers than their male counterparts in science and technology worldwide. India is an outlier in this regard as well. According to a

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<sup>6</sup> Source is the online article from The Print, 22 March 2021 edition.

recent study published in the journal of informetrics, one third of the research papers are authored by women in India. Despite their accomplishments, women may receive minimal credit and money, which leads fewer women to enter the sector. Women make up only 15% of professorships in science.

Women account for a third of the Ph.D. winners in research programmes. As a result, universities are now working to accomplish something that has long been assumed – gender parity. According to a report in the Times of India, efforts are being made by the Ministry of Science and Technology to rank colleges teaching STEM courses based on gender equality in India by January 2020. The government is supposed to include over 90 educational and research institutions in this new ranking system. Twenty Indian institutions, including the Indian Institutes of Technology (IITs) and the National Institutes of Science (NITs), have come forward to accomplish this mission.

Science education and research in India got wide acceptance after independence. So, the following section will briefly discuss science in India in the post-independence period.

### **Science Education and Research in India: Post-Independence Scenario**

Scientific rationality-based knowledge penetrates and moulds current socio-political and economic structures. The post-independence age in India has seen a remarkable expansion of science and technology. India faced a dual challenge after independence: improving literacy rates on the one hand, and boosting scientific and technological development by establishing world-class higher education institutions on the other (Mittal et al., 2020). The Department of Science and Technology (DST) has been instrumental in deciding and encouraging significant research areas in many science and engineering fields since the 1970s. The Science and Engineering Study Council (SERC) is a peer-reviewing council comprised of notable scientists and technicians tasked with identifying new interdisciplinary research fields and peer-reviewing research. Other professional groups that encourage specialized sectors of science and technology include the Council of Scientific and Industrial Research, the Indian Council of Agricultural Research, and the Indian Council of Medical Research.

In addition to these, there are also departmental laboratories in several departments and ministries. Even though India boasts over 900 universities and other institutions of higher

learning, only 6 percent of the population has access to higher education (Mulimani 2004:12-18). In India's higher education sector, there are a variety of inequalities. For example, the different types of institutions, such as institutions of excellence, public universities, private universities, and those deemed to be universities, reflect inequalities in financial and human resources, as well as a skewed distribution of students from various castes, classes, genders, and urban and rural backgrounds (Mittal et al., 2020). Elite men are the only ones who have access to this schooling. In a capitalist society, the prestige associated with employment in science and technology will make science education exceedingly expensive and thus exclusive. Industry, research institutes, and educational institutions work together to improve science education and research (Ramamurthy 2003).

Only those fields of knowledge that have the potential to make money will be developed. Thus science and technology education became more of a financially lucrative venture by keeping aside its ideals and efforts for humanitarian purposes such as poverty alleviation, economic growth and civic development. As a result of these business compulsions, the institutional frameworks within which science is done will become exclusive. The insights garnered by different subaltern movements that emerged in the political milieu of the 1960s are used to uncover the politics of exclusion in institutional practices and regulations controlling science education and research (Poonacha, 2005).

### **Women in Science: An Amalgam of Indian Experience**

Women focused only on feminine and non-market courses in the early post-independence period. Karuna Chanana outlines how globalization pushed for the privatization of education, which increased in the individual cost of education. She also talks about how these changes have influenced women's aspirations for professional courses and subject choices (Chanana, 2007).

When we analyze the Indian context of women and science education, it should be noted that women's entry into science education and research was mainly a post-independence phenomenon. The then Prime Minister Jawaharlal Nehru's promotion of science and technology and the establishment of scientific institutions for education and research paved the way for women to enter science education and research and later into a science career. So, the studies on Indian women in the science field came only after the 1970s, and they were just peripheral kinds

of studies. Detailed studies came only after the 1990s (Gupta & Sharma, 2002). In the 1990s, more women entered pure science than men (Poonacha, 2005). These studies discussed the specific issues faced by women trying to enter and survive in science. Whether in education, research, or profession, how do women fit into male-dominated scientific styles and practices, their coping strategies, etc. Science and engineering have traditionally been regarded as male-dominated areas in India, and women's participation in advanced education in science is extremely low.

Social prejudices and culturally unique norms penetrate academic institutes because they are entangled in the local sociocultural framework. The unofficial, informal Ph.D. training process frequently excludes women. Fox (2000) discovered that women benefited less from the supervisor-research scholar relationship in significant areas such as preparing research plans, proposals, publications, and organizing skills. The enrolment proportion of women at all levels in famous institutes such as the Indian Institutes of Technology (IITs) is substantially lower than national percentages. Even though over 80 percent of women graduate with university gold medals in Indian universities, their presence in the workforce in science and technology<sup>7</sup> is as low as 7.7 percent. Greater female participation in science education does not imply a reduction in occupational gender segregation. In science, women have a higher socioeconomic status than men. Upper-class families with better educational and financial backgrounds are more likely to send their daughters to pursue a career in science. Despite their improved socioeconomic status, they are nonetheless at a disadvantage in gender.

In India, women pursuing Ph.D. degrees in science appear to confront issues similar to those seen in the West. Several behavioural patterns exist in science, even though we can't see any formal rules that discriminates women. Female scholars believed that in order to prove themselves, women had to work harder than males. Women's existence in science is harmed by a lack of critical mass of women in science in the informal scientific milieu. Because of the low proportion of women, there is more visibility and tokenism. Tokenism refers to the practice of making a token or symbolic effort to be inclusive of members of minority groups, such as recruiting people from underrepresented groups to provide the illusion of racial or gender equality in the workplace. The purpose of including a token employee in a workforce is usually

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<sup>7</sup> Source is the online article by Times of India 2002.

to give the idea of social inclusion and diversity (racial, religious, sexual, etc.) to deflect allegations of discrimination. This leads to boundary preservation and a greater consciousness of tokens, which withdraw them from informal contacts. Supervisors are the only sources of power, and it is clear that men and women are not equally related to this source of power. Men have the upper hand in relationships with supervisors and benefit from it.

Sometimes, informal encounters with them lead to extra work tasks, which can be inconvenient for the students but they can't refuse. Women are typically assigned fewer additional responsibilities, reflecting a lack of mentorship. The adviser plays an essential role in promoting morale, providing support, and offering career advice. However, faculty politics can have an impact on interactions with scholars. Other aspects that affect scholars' academic lives include the advisor's preference for certain pupils and competition between the supervisor and other faculties. When it comes to research life, it's equally crucial to interact with your peers. Women-to-men interaction is essentially a one-way requirement because men hardly require the assistance of their female fellows. One of the most serious issues that female Ph.D. students experience is the absence of a friend circle (batch mates and seniors) to seek advice and support. Women lack informal friendship networks, and they are further alienated due to sexist politics among academics. Among the scholars, there are multiple hierarchies among juniors and seniors, and groupings based on gender, seniority, supervisory favoritism, regionalism, or shared interests. Male pupils believe that because of their gender, female researchers can get things done quickly.

There's also a substantial divide between what men and women believe is available to them. Men experience deprivation because they think women receive unfair benefits from their sex and utilize their sex to get things done. In terms of the types of equipment, materials, gaining cooperation from instructors, clerical or laboratory workers, other students, mentorship, and the availability of collegial relationships, women feel disadvantaged. In science, subtle gendered behaviors and procedures amplify the issues in informal practices. The casual environment is occasionally tainted by security failure on campus, especially by eve-teasing harassments by outsiders. According to popular belief, women are stereotyped as "chaste," which means they abstain from adulterous or all sexual relations. Hence, they should be divided into such actions of

institutional sexism are almost invisible, lending validity to the claim that science institutes' rationality and universalism conceal gender-related issues.

Society always tries to control the interactions of women in various ways. Female sexuality was under surveillance and control by society through female seclusion and gender segregation. These historical practices that controlled women and determined their social status are also reflected and repeated in scientific institutions. Informal interaction of women in these institutions was based on this unique socio-cultural milieu. As a result, the status of women in science and society is intertwined. The lethargic nature of science in India also affected female scientists. It is ironic that experts at the country's top research organizations see nothing unreasonable in following religious practices and beliefs in their offices and allowing caste inequalities (Gupta, 2007).

Science is often connected with meritocracy, and its norms are universal. However, the current circumstances in the world and India in particular, are ironic and contradictory. [Research and Development Statistics (1996-97)]<sup>8</sup> says that in India, women account for only one-third of overall enrolment in higher education in science and roughly one-seventh in engineering. The number of women studying science and engineering has increased. The allure of "earning wives," as well as the prestige of science and engineering studies and occupations, leads to high chances of getting skilled husbands. The proportion of women enrolled in pure science topics in educational institutions has risen from around 7 percent in 1950-51 to around 34 percent in 1996-97. [Chanana et al., 2000]. Gender inequality in science results from the socio-cultural context in which it is carried out. As a result of their gender, women academic scientists face three major challenges. First, there is widespread male dominance in the workplace. Women are at the bottom of the professional ladder. Women must work significantly more than men to demonstrate that they are equally capable. Male co-workers find it challenging to recognize women as equals. At least at the start of their careers, women's abilities are questioned.

There were certain stereotypic preoccupations with women in science careers. Some of them can be understood as women are not suitable to manage certain engineering areas, women will not be able to do the groundwork, and women cannot effectively instruct men and getting faculty

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<sup>8</sup> Research and Development Statistics 2019-2020 (GoI) about the higher education, says that in the academic year 2018-19, women in science comprise 52.4% of the total and women in engineering comprise 31.9% of the total.



positions is uncommon, so they will not succeed like their male counterparts. In a highly male-dominated atmosphere, the need to be noticed causes psychological stress that undermines one's ability to work. Women are also underrepresented at the highest levels of administration. Women are being neglected due to a lack of supportive amenities. Women's needs are mostly ignored by the system. The second is a sense of isolation. The fundamental reason for this is a lack of informal engagement. It's challenging to interact with male professors. Male and female intermixing is restricted due to social segregation rules. As a result, both men and women try to maintain a social distance from each other and tend to keep each other out of informal interactions. Women are unable to make contacts; they are unable to converse, drink, or sit in the evenings when the names for various committees are chosen. Fewer contacts are also due to family pressures and time limits. Women's lack of regional mobility limits their capacity to attend seminars and conferences, making them less visible and limiting their ability to develop informal networks.

Furthermore, female scientists are underrepresented among co-workers, collaborators, and administrators. The third point of contention is the tension between being a woman and being a scientist. This gender role conundrum balances the gender role with the professional position. According to gender stereotyping, women are expected to be submissive by their co-workers. Women who express their thoughts or assert themselves are not considered "normal women." This is also a product of people's usual mentality. Men want women to act like "women," but it is looked upon when a woman experiences an exclusive of her sex, such as pregnancy. In such instances, some co-workers may not be very considerate. It takes a long time for a woman to be professionally recognized; the system is oblivious to women's unique demands; and female academics are stressed by the societal expectations of gender roles and the isolation they encounter in the academic environment. Because of the additional social obligations, marriage impacts one's work.

Marriage has an impact on a woman's professional career because of migration. Pregnancy and parenthood may result in a career pause or, at the very least, neglect of research. Scientific production suffers as a result of motherhood. Indian culture considers motherhood universal and honors it with social esteem, so it is impossible to escape its grips. Even though marriage is a personal choice, unmarried or divorced women are treated indifferently in India, so they may not

generally do better at work. Compared to single, widowed, or divorced women, married women's research activity is far better in many terms such as the average number of publications and participation in conferences. For married women in India, the system is more favorable than for unmarried women.

In comparison to married women, single women are treated disrespectfully and society tends to corner them with character assassinations. Although many household responsibilities are inescapable, some academic women have had cooperative in-laws and have gotten collaboration from their spouse in domestic activities. The following are the main coping mechanisms women use in scientific research and professions: First, make a career compromise. Women sometimes prioritize their home duties, impeding the advancement of a career in academic science. The second is deferring research. They go for a break in their career because of the work pressure and family restraints in the early years. A considerable decrease in the number of research papers and withdrawal from national and international conferences and seminars are seen in women in science between the ages of 40 and 45. Children's studies are also prioritized by women from the educated middle class. The third option is finding fulfillment through a re-definition of "success". Being "successful" for a man would imply professional recognition, awards, and the most significant honors. Contradictorily a successful woman is one who can manage both her home and her profession. Marriage and motherhood are considered a woman's "dharma" (holy obligation) in Indian culture; hence a woman should not sacrifice her family for a profession. Female scientists must recognize that their specific issues result from their social and working environments (Gupta & Sharma, 2002).

Once women make up 10-15% of a group, they face fewer difficulties in their careers. The achievement of critical mass has the ability to reduce "socialization issues," affect policy-making and tenure choices, as well as reduce the function of "gender schemas." Having reached critical mass allows you to tap into a more extensive network of women for support and counsel. When combined with gender preconceptions, the lack of critical mass becomes even more problematic. Stereotypical notions of what tokens (women) "must be like" appear to clash with the concept of a "scientist." Critical mass may also boost women's acceptance in traditionally masculine sectors and create a more women-friendly work environment (Gupta, 2007b).

Laboratories have a gendered work environment that is rarely discussed. A male is generally preferred (for appointments) because he can work for a more extended period of time, while a female has other responsibilities. A scientific career also necessitates a "male model" of lengthy working hours and full-time dedication. Women are thus judged less efficient if they do not follow the "male model," regardless of how much work they accomplish. Because of the dual-burden assumption, it is assumed that women have less time for science and so are unable to do quality research. Hasan et al. discovered that there was no difference in the quality of production between men and women and that the proportion of scientists publishing in SCI journals was the same for men and women, at 63 percent. Gender and organizational studies agree that hierarchical hierarchies are places where men rule. In research laboratories, hierarchies combined with inefficiencies in organizational procedures disadvantage women scientists and maintain gender segregation (Gupta, 2014).

In a separate study of women scientists in India, it was discovered that, despite their education and social status, patriarchal attitudes impact the careers of women scientists just like they do on women working in unorganized fields or other professions such as doctors and lawyers. In India, biological sciences employ far more women than physics, chemistry, or mathematics, the other major natural science fields. Certain particular steps and goals are required for career growth in academic research in the biological sciences. Having solid employment is, of course, an essential requirement for a career. One of the most important criteria for the selection of biology faculty posts in our country now is to have a documented track record of accomplishments such as publications in prestigious journals. Peer opinion has a number of effects on the future direction of a career, both positively and negatively.

This study examines how women scientists in India compare to males to achieve various professional goals. We can witness the competition between men and women in science research and careers because the employment sector doesn't directly have any formal bias towards any genders. It also examines whether, in reality, women are given equal opportunities and chances as junior faculty positions in institutions and laboratories where biological science research is conducted, in proportion to the percentage of women who earn Ph.D. degrees. There is no link between the institute's age and the percentage of women who work there. According to the

findings, there is a slight mismatch between the number of women in permanent faculty positions and the number of women at the research level; the former is lower than the latter.

Even though men and women are of the same age and have the same qualifications, women may get fewer career chances than men. Because women prefer to take care of "family's demands" over their academic and career goals, they often take short or long years off. As a result, fewer women scientists may apply for permanent positions after completing post-doctoral studies, and fewer may compete with men for the same position. When comparing the proportions of women in senior and junior positions within an organization, the ratio of senior female faculty members is consistently lower. In contrast, women make up a more significant proportion of junior faculty members.

To begin with, we can see a positive change in that more young and qualified women are being appointed to jobs despite the existing gender differences. Second, even if they are equally qualified as their male counterparts, women junior faculties are not easily promoted. As a result, a combination of these factors may result in a higher number of women in junior positions. This study also found that women scientists' high-quality productivity is not proportional to their proportion of job representation. One probable explanation is that the female scientists employed aren't as "excellent" as their male counterparts when formulating and executing research plans. Other factors could be linked to environmental issues that affect women specifically. In addition, interactions with female scientist colleagues during the study generated a sense that women tend to underrate their talents, which society is responsible for. These assumptions can cause harm to the productivity of women scientists. They can cause them to step back from requesting financial assistance for research as a male colleague would, asking for less funding for the same work, not sending research work to prestigious journals, and not arguing the case for revisions in the event of apparently critical referee reviews on submitted manuscripts.

Even though men and women are equally productive, women tend to encounter more challenges in obtaining peer approval from immediate co-workers. Achievements must be shared with peers, and the capacity (or inability) to do so can impact one's professional prospects. This is because a scientist's co-workers substantially affect on her or his advancement and successes in other areas of their career. When it comes to fulfilling goals, women scientists might quickly fall behind since their personal interactions with male colleagues are severely limited by patriarchal

cultural boundaries of so-called morality. Getting nominated to government-created advisory committees is another evidence of a scientist's gaining status in the community. This could entail serving on committees that decide whether or not proposals for extramural financing from the CSIR, DAE, DBT, DST, or ICMR should be accepted or rejected. It might also mean serving on a national institution's research advisory board, scientific advisory committee, or research council.

According to studies, men's representation in committees, where personal connections with the fellows and their recommendations are helpful for nomination, tends to be lower. Even in academic performance-based competition, gender discriminations predominate, notwithstanding a rise in the number of women scientists in natural sciences. Long working hours can adversely affect people in any profession. When combined with family responsibilities and gender-based socio-cultural expectations, women are most affected by the long work hours. Women start to get societal and family pressure to get married when they step into their twenties, and it gets more intense with every passing year. Once they are married, they are forced to take short or long breaks for family necessities. In most cases, such breaks always have a negative impact on your career. These career gaps will leave a black mark in their career profile that is powerful enough to influence their future (Bal, 2004).

In India, scientific institutes are highly hierarchical and competitive in nature. Women must either altogether quit or adjust their goals. Female scientists appear to be concentrated in the life sciences and chemistry, but not in the earth sciences, physics, or mathematics. In senior positions, very few women have been a part of these systems. Their involvement is limited to the junior levels, and even if women reach senior decision-making positions, they are powerless to influence these organizations' inherently masculine character.

The most critical issue confronting universities and other higher education institutions in India is a lack of resources. Institutions, particularly women's colleges, suffer from a lack of funds. Any increase in the cost of education based on the idea that the user pays for services, and eliminating of public assistance for education, will impede women's access to school. The fundamental goal of education is under threat now because it seems like the idea of critical thinking and opposition to anything that is regressive in nature has been lost in education and research. Education is increasingly being used as a tool of indoctrination used by the right-wing to fulfill their political

agendas and propagate their ideologies using scientific jargon. It is against women attaining education and encourages women to return to their homes. Scientific institutions and ethos reflects the existing social, political, and economic milieu that systematically exclude vast segments of the population through its practices, especially women, from the process of knowledge creation (Harding 1986: 15-30). Because scientific institutions are a part of the existing social structure, history will repeat itself in the form of impediments to women receiving education, self and social esteem, or social status and positions. Likewise, society ensures that women never surpass men of the same qualifications in anything and reach a higher position.

Even when statutory barriers have been removed, discriminatory practices are frequently maintained informally. Scientific reason is commonly invoked in implementing social programmes to justify the control and exclusion of marginalized populations. In science, the epistemological emphasis on rationality and impartiality often conceal the researcher's bias. The dominant group's worldview is enrooted in the information created in an institutional setting, and it is represented in the choice of the problem, methodology, and solution. The consequences of such unrecognized biases and tendencies are inherently counterproductive to scientific practice. They prevent the development of alternative and divergent ways of knowing, limiting the expansion of scientific inquiry and knowledge [Harding 1990:83] (Poonacha, 2005).

Modern science is defined by its embrace of the mechanistic worldview, transforms nature, which was formerly considered vibrant and living, into a lifeless machine. This worldview, combined with the widespread association of nature with women, developed a sense of dominance and control over both nature and women (Fehr, 2004). When we talk about women in science in more depth, we may notice first-hand concerns about women and second-hand gender and scientific issues. And there is a triple burden that includes "surplus anxiety." These are other factors affecting male scientists, such as the pressure to obtain funding, produce results, and gain fame. Despite specific regional differences, the gender gap in science exists across civilizations. Feminist historical studies have also brought light on the roles and achievements of a large number of women who traditional science histories have overlooked. The analysis of their personal and environmental situations reveals that their familial and social positions both help and hinder their scientific growth. Even Marie Curie (1867–1934) struggled with a lack of

recognition and avoidance. Married women are regarded as a "safety valve," as they are the first to be dismissed and the last to be employed (Bansal, 2018).

In the Indian context, diversity will have to address not only gender issues, but also caste, class, and rural-urban divides. Inequality is seen in women's participation in formal education at all levels. Within the more excellent framework of diversity, the history of women's involvement in science and technology has been marked by exclusion and inequity. Women's inclusion must be adequately examined to maximize diversity's potential and provide India with a competitive edge in global science and technology. Women are not just consumers of scientific information but also producers of it. Discrimination was more indicative than illustrative and subtle in nature. Women drop out of scientific research after receiving a Ph.D. for various reasons, including a lack of job prospects, institutional problems, and an opaque selection procedure. Systemic biases in science and technology institutions cut a woman's scientific career short, as well as her family's. Even in nations where girls are highly represented in science courses at the undergraduate level, there is an apparent pyramidal effect, with the number of women at the Ph.D. and post-doctoral levels falling dramatically (Kurup, 2017).

There is a need to go beyond traditional notions of family and childcare duties as the cause of women's dropping out of science and emphasize the relevance of supportive and facilitative workplace procedures critical to ensuring women's retention in science. Offering "facilities to manage various tasks—such as providing on-campus housing, transportation, and childcare and eldercare" is one of the organizational recommendations provided. In addition, there is a need to provide scheduling flexibility to help people combine family and work obligations. Mentoring programmes with incentives for mentors would also be an essential organizational mechanism for retaining women. To gradually increase the number of women in science, a mandatory gender audit should be implemented at the policy level, with mandatory requirements for all research institutions, universities, national laboratories, and other institutions to provide a department-by-department gender break-up of students and faculty at all levels.

Furthermore, a time-bound target recruiting strategy emphasizing improving the recruitment of women to premier research institutions is required. Another key policy concern would be the openness of the selection and review processes. It is necessary to investigate new methods of job creation. Ways to broaden the formal space within science and technology must be explored to

develop additional professions suited for female candidates with doctoral degrees. One strategy could be to attract venture capital to help grow science infrastructure, with possible patenting provisions for entrepreneurs who invest in research. Existing initiatives for the re-entry of women into science need to be modified. Another measure that will improve job chances for women is a policy that allows spouses to work at the same institution (Kurup & Maitreyi, 2011).

### **Policies on education**

In addition, some studies look at policy interventions and advances in science education and research in India. Understanding some of the reasons for women's marginalization requires looking at India's educational and science policies. Not only is there a disjuncture between stated policy and the reality on the ground, but certain assumptions regarding class, caste, and gender are also unquestioned. In addition, the majority of these policies failed to address the issue of women's education. The importance of educating women was discussed in the National Policy on Education (1964–66). Still it failed to see women's education beyond a tool of social transformation and to consider it as an inherent value or entitlement.

On the other hand, the policy emphasized the importance of quickly expanding science and technology education and research in India. The National Policy on Education (or the Kothari commission report) recommended a comprehensive programme to promote a scientific mindset in education, increase research capacity and excellence, and foster inter-institutional collaboration. Although the Fifth and Sixth Five-Year Plans included women's education, they also failed to emphasize the importance of and to put forward any practical possibilities to assure that the doors of science and technology are widely open to women.

The Committee on the Status of Women's Report (1974), often known as the Towards Equality Report, established defined rules for female education (GoI 1974). The Five-Year Plans (since the 1980s) agreed upon the afore-mentioned report and understood that women were systemically being excluded from the arena of planning and development. They also realized that education could be used to end this gender discrimination, to achieve equality and also to help women to articulate themselves. These initiatives, in addition to enhancing facilities for women's education, have urged that the curriculum be restructured, gender prejudices be removed, and higher education for women, particularly professional or technical education and



employment, be emphasized. The resulting national debate identified a number of fundamental challenges that the strategically new education system must address to educate the proceeding generation for the twenty-first century, characterized by advanced scientific, technological, and industrial development (Poonacha, 2005).

### **Policies on Science Education**

The major sources we can use as a reference to understand the growth and development of science in our country are the Scientific Policy Resolution [Gol 1987], Technology Policy Statement (1983), Perspective Plan for 2001: Role of Science and Technology, which came from the Science Advisory Council to the prime minister [Gol 1992b], and Science and Technology Policy [Gol 2003a]. The major focus areas of these documents are as follows,

- Strengthening of the basic research
- Development of applied research and technology
- Transfer of laboratory knowledge to end users.

Analyzing these documents can reveal the underlying beliefs that influence science and technology development. Apart from the Science and Technology Policy of 2003, these documents failed to focus on issues of equity. They couldn't contribute to the upliftment of women and other underprivileged and marginalized sections of society in the system of knowledge generation. They also did not attempt to highlight the possibilities of discarding the top-to-bottom approach to knowledge transfer from laboratories to people and to introduce it as a two-way communication model. Anyhow, it is not wise to expect these documents to treat women and other marginalized sections of society with equal rights as they are primarily made by male groups. Some policy pronouncements are directly dangerous to women when viewed through the lens of gender justice (Poonacha, 2005).

Lalita Subrahmanyam's work emphasizes 'patrifocality' (a family environment-oriented or centered on the father). She discusses the elements that influenced women's decisions to pursue science as a specialization, including encouragement to pursue further education and the conditions that led to the decision. The patrifocal structure of the Indian family is highlighted since the family, not the individual, makes decisions regarding the individual, such as schooling.

The majority of such decisions will almost certainly favors male members over female members (Subrahmanyam, 1995).

According to one study, there is no contradiction between having a scientific job and having a family. On the contrary, the study finds that while having a family adds to a woman's workload, marriage appears to positively impact her professional life and that married women scientists perform better in their research and profession than their single counterparts (Luukkonen-Gronow & Stolte-Heiskanen, 1983). Women's contributions to science and their participation have various effects on the interaction between science and society. By shifting society's mind-set toward working women, the underrepresentation of women in science, poor employment and promotion prospects, and high dropout rates in scientific professions can be reduced. Women's engagement in the policy formation process is critical to significantly changing science policies. The administration is also committed to empowering women in science. Under the Ministry of Science and Technology, the Prime Minister's Scientific Advisory Council has organized a Task Force on Women in Science to assist the government in paying constant attention to the concerns of women scientists and thereby encourage women to pursue scientific careers. The expansion of their network should be encouraged in order to help female achievers connect as mentors, supporters, and collaborators in science. Other ideas include boosting female role models to inspire young girls and eliminating gender-specific vocations; there are no such things as "feminine" or "masculine" disciplines (Singh & Bhagi, 2011).

## **Summary**

This chapter briefly discusses women in science, whether it is research or profession, from the experience of foreign writings in the first half and of Indian writings in the second half. The global advancement of women in education can also be traced and connected to the various developments of the feminist movement in the world. Because of the different versions of feminism addressed the status of women's education and fought for it. So, this chapter attempted to examine various feminisms, particularly those based on identities, such as Black feminism and Muslim feminism, in relation to their contributions to women's education. We also discussed various pieces of literature that addressed the quality and quantity of women in science education and professions. Their problems and challenges are brought into the limelight through different

study reports. We got to know various issues women face in science, both when they try to enter the field of science and after entering science education, research, or professions.

The chapter discussed various forms of discrimination women in science face despite time and space. This chapter also explains the importance of science education and research in India. Especially it focuses on the experiences of women doing science education and research in India. The focus was on the challenges and issues women confront while doing their higher studies and professions in various branches of science in India. These issues include infrastructural facilities, peer group and supervisor support, and different social and cultural factors. It put forward various studies based on Indian scientists and scientific institutions to understand the problems faced by women scientists in India. The chapter discusses a brief overview of the trajectory of science education and research in India following independence. This chapter also looked at certain education and science policies regarding women scientists, where it can be understood that these policies also paid less attention to the challenges women scientists face.

## Chapter 3

### WOMEN SCHOLARS IN SCIENCE AT THE UNIVERSITY

#### Introduction

This particular chapter is based on the data collected from the field through interviews with the respondents. It also includes secondary data obtained from the university records to support the study's objectives. The following session deals specifically with women in the university within the framework of the study's major objectives. This chapter is divided into different parts. The first part of the chapter gives some numerical data on the female students and scholars in the university, and the second part describes the respondents' personal profiles. This chapter will provide an overview of the university's female research scholars.

When we look at the idea of the university, for Nagaraju, it represents a critical examination of a university's intellectual and social past. On the other hand, it indicates a conflict between numerous spaces and identities inherited from and developed by the institution. Students' caste, class, gender, religious, regional, linguistic, and political perspectives all influence the social values and meanings associated with these 'spaces.' The significance of plural branches of knowledge is also emphasized in shaping the true spirit of the university (Gundemeda, 2015).

According to Namrata Gupta, women scientists are a valuable human resource for any country. In India, social scientists' publications have brought to light the enormous inequality and masculinity inside the scientific institutions. In recent years, there has been a growing awareness among female scientists that the challenges they face are not unique to them, but rather shared by their peers, as evidenced by many seminars, conferences, and committees (Gupta, 2015).

#### **Part 1- A general look into women students at the university**

The University of Hyderabad is the country's top postgraduate teaching and research institution. The objective of the university is

“to disseminate and advance knowledge by providing instructional and research facilities in such branches of learning as it may deem fit and by the example of its corporate life, and, in particular, to make special provisions for integrated courses in humanities and science in the educational programmes of the University and to take appropriate measures for promoting inter-disciplinary studies and research in the University.”

Over the years, the teaching and research programmes of the University have been firmly established. The pupils are recruited by a nationwide entrance test. Around a third of the students are Ph.D. researchers, with women accounting for around 40% of the total. At the University's 21st Convocation on October 1, 2019, a total of 31,467 students were given various degrees, including 3,303 Ph.D.s, 4,855 M.Phils, 2,594 M.Techs, and 20,715 Postgraduate Degrees and Diplomas. There are 201 professors, 83 associate professors, and 142 assistant professors on the University's faculty. The student-to-teacher ratio is 1:3. The University's Faculty has published widely and received research funding from various sources. The University of Hyderabad was granted Institution of Eminence designation by the Government of India in September 2019, recognizing the university's stature, aptitude, and potential to join the ranks of the world's most significant institutions. The university is poised to rank among the World's 500 Best Universities in the coming years, with greater financing and autonomy.<sup>9</sup>

The university encourages female students to attend various courses by providing them with hostels and other facilities on a priority basis. Since the university's inception, female students admitted to various courses have been relatively high. The university provided hostel accommodation to all outstation female students and tried to provide hostel accommodation to those in the Twin Cities who needed it. The university data shows that the enrolment of female students in various courses increases each year.

Let's look at the number and percentage of female students enrolled in the university, for various courses under different departments, since the inception of the university<sup>10</sup>.

**Table 3.1 Number of women students enrolled in the University since inception**

| Year    | No. of women | Total | Percentage |
|---------|--------------|-------|------------|
| 1975-76 | 11           | 47    | 23.4       |
| 1976-77 | 25           | 73    | 34.2       |
| 1977-78 | 66           | 161   | 40.9       |
| 1978-79 | 104          | 241   | 43.1       |
| 1979-80 | 199          | 445   | 44.7       |
| 1980-81 | 269          | 537   | 50.0       |
| 1981-82 | 267          | 550   | 48.5       |
| 1982-83 | 290          | 668   | 43.4       |
| 1983-84 | 331          | 690   | 47.9       |
| 1984-85 | 328          | 742   | 44.2       |

<sup>9</sup> Source is the admission prospectus 2021 released by the university.

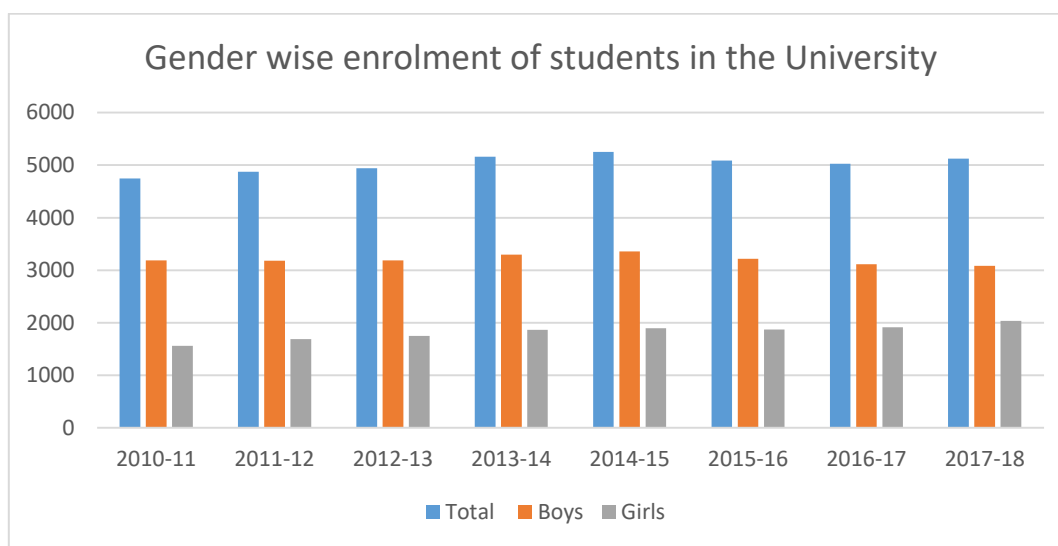
<sup>10</sup> Source is the Annual reports released by the university from the academic year 2010-11 to 2017-18.

|           |      |      |       |
|-----------|------|------|-------|
| 1985-86   | 380  | 928  | 40.9  |
| 1986-87   | 435  | 1143 | 38.0  |
| 1987-88   | 547  | 1425 | 38.0  |
| 1988-89   | 548  | 1504 | 36.4  |
| 1989-90   | 651  | 1578 | 41.3  |
| 1990-91   | 634  | 1720 | 37.0  |
| 1991-92   | 696  | 1828 | 38.0  |
| 1992-93   | 786  | 1934 | 40.6  |
| 1993-94   | 776  | 1964 | 39.5  |
| 1994-95   | 758  | 2042 | 37.1  |
| 1995-96   | 768  | 2048 | 37.5  |
| 1996-97   | 726  | 2043 | 35.5  |
| 1997-98   | 669  | 2018 | 33.2  |
| 1998-99   | 677  | 2062 | 32.8  |
| 1999-2000 | 710  | 2144 | 33.1  |
| 2000-01   | 727  | 2193 | 33.2  |
| 2001-02   | 750  | 2348 | 31.9  |
| 2002-03   | 775  | 2388 | 32.5  |
| 2003-04   | 760  | 2477 | 30.7  |
| 2004-05   | 797  | 2530 | 31.5  |
| 2005-06   | 842  | 2641 | 31.9  |
| 2006-07   | 851  | 2707 | 31.4  |
| 2007-08   | 961  | 3067 | 31.3  |
| 2008-09   | 1081 | 3426 | 31.6  |
| 2009-10   | 1356 | 4160 | 32.6  |
| 2010-11   | 1561 | 4746 | 32.9  |
| 2011-12   | 1688 | 4871 | 34.67 |
| 2012-13   | 1752 | 4939 | 35.49 |
| 2013-14   | 1864 | 5159 | 36.13 |
| 2014-15   | 1894 | 5249 | 36.08 |
| 2015-16   | 1870 | 5089 | 36.75 |
| 2016-17   | 1912 | 5028 | 38.03 |
| 2017-18   | 2039 | 5124 | 39.79 |

When we analyze the number and percentage of female students over various subjects in different departments of the university, the lowest number of female students was in the first academic year after the establishment of the university. During the academic year 1975-76, 11 female students were enrolled out of 47 total enrolments. The number of women enrolled was 23.4% of the total enrolment. Later, the percentage of female students enrolled never went below 30% of the total enrolment. The percentage of female students enrolled varies every year, and it ranges from 30% to 50% of the total enrolment. The highest number of women enrolled in the university was in the academic year 1980-81. During that particular year, out of 537 students who enrolled in the university, 269 were women.

This represents half of the total enrollment for the year. Almost every year, we notice an increase in the total enrollment. The number of female students enrolled also increased virtually every year. So, the increase in the total enrolment is positively correlated to the number of women enrolled each year. But the percentage of women enrolled in each year of the total enrolment flipped back and forth every year. When we check the enrolment of recent years, from the academic year 2007-08, there is a more or less steady increase in the number of female students.

When we look at and analyze the admission trends in the latest decade of the 21<sup>st</sup> century,



**Graph 3.1 Gender wise enrolments of students in the University<sup>11</sup>**

The total number of students enrolled in different courses at the university during the year 2010–11 was 4746. Of these, 1946 were freshmen and 2,800 were seniors. There were 1561 female students on the rolls of the university, i.e., 32.89% of the total number of students. The enrolment of students in different courses offered by the university during the 2011–12 academic year was 4,875. Of these, 1,783 were freshers and 3,092 were seniors. There were 1,689 female students on the rolls of the university, i.e., 34.7% of the total number of students. The enrolment of students in different courses at the university during the year 2012–13 was 4,939. Of these, 1,779 were freshers and 3,160 were seniors. There were 1,752 female students on the rolls of the

<sup>11</sup> Source is the annual reports released by the university from academic year 2010-11 to 2017-18.

university, i.e., 35.47% of the total number of students. The total number of students enrolled in different courses at the university during the year 2013-14 was 5,159. Of these, 1949 were freshers and 3210 seniors. There were 1864 female students on the rolls of the university, i.e., 36.13% of the total number of students. The total number of students enrolled in different courses at the university during the year 2014–15 was 5249. Of these, 2012 were freshers and 3237 seniors.

There were 1894 female students on the university's rolls, accounting for 36.08 percent of students. The total number of students in different courses at the university during the year 2015-16 was 5089. Of these, 1998 were freshers and 3091 were seniors. There were 1870 female students on the university's rolls, accounting for 36.08 percent of the total number of students. During the 2016-17 academic year, 5028 students were enrolled in various courses at the university. Of these, 1899 were freshers and 3129 seniors. There were 1912 female students on the university's rolls, accounting for 38.02 percent. The total number of students enrolled in different courses at the university during the 2017–18 academic year was 5,124. Of these, 1951 were freshers and 3173 were seniors. There were 2039 female students on the rolls of the university, i.e., 39.79% of the total number of students.

The Government of India's Department of Science and Technology (DST) has sanctioned Rs. 11.96 crores to four Science Schools of the University to supplement research facilities through the FIST (Fund for Improvement of Science and Technology). Thus, it is understandable that the reputation of the university in science and technology education and research. So now let's look at the statistical data regarding women in faculties and students in major science subjects at the university.

### **Women Faculties in Major Science Subjects in the University**

The number of female faculty in the major science subjects is also important here as it helps us to understand how far Indian women have reached with regards to their science careers. The following table, we will glance at the gender-wise distribution of faculties in the major science subjects<sup>12</sup>. The data is obtained from the university's latest prospectus and the official websites

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<sup>12</sup> The data on the number of faculties is obtained from the latest admission prospectus (2021) released by the university and also from the official websites of the respective departments and schools of studies. Certain



of the respective schools of study and departments. This data could be empirical evidence of the gender disparity that we read about in the previous literature pertaining to women in science in India.

**Table 3.2 Gender-wise distribution of faculties in major science subjects.**

| <b>Department</b>                | <b>Male</b> | <b>Female</b> | <b>Total</b> |
|----------------------------------|-------------|---------------|--------------|
| Mathematics & Statistics         | 12          | 6             | 18           |
| Computer and Information science | 37          | 11            | 48           |
| Physics                          | 28          | 9             | 37           |
| Chemistry                        | 31          | 2             | 33           |
| Life sciences                    | 50          | 16            | 66           |
| Medical sciences                 | 6           | 4             | 10           |
| <b>Total</b>                     | 164         | 48            | 212          |

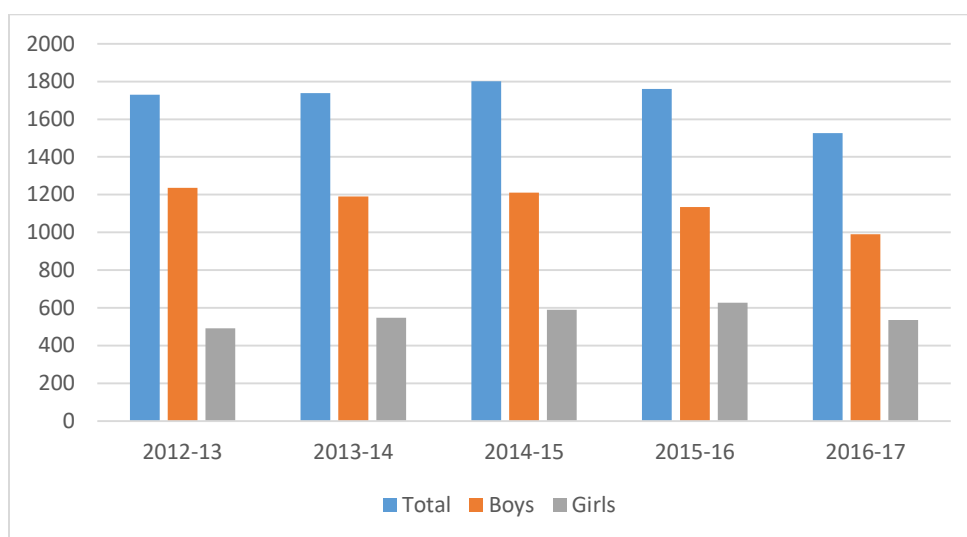
The gender disparity in the distribution of faculties in major science subjects is highly visible from the table. In most of the schools of study, the number of male faculties is doubled or tripled, sometimes even more than the number of female faculties. The highest number of female faculty is seen in the school of Life Sciences. The School of Life Sciences has 16 female faculties in different departments under it. The number of male faculties is also high in the school of Life Sciences that is 50. The lowest number of female faculties is in chemistry. There are only 2 female faculties in chemistry as we can see from the table. The lowest number of male faculty is seen in Medical Sciences. There are only 6 male faculties in it, but it is still higher than the number of female faculties in Medical Sciences. There is not a single school of study where we can see that female faculty outnumbered their male counterparts.

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departments are single-disciplinary, and others are multi-disciplinary, including those that include different research centres in them. The statistical data is a sum total of all these centres and departments.

### Enrolment trends of women in significant science subjects

From a gender perspective, as this research deals with the students who opted for science for their higher education and research, let's look into the enrollment of students in major science subjects provided by the university in recent years. It will help us understand the gender gap in each of the major science subjects at the university.



**Graph 3.2 Gender-wise distributions of students in major science subjects<sup>13</sup>.**

The above graphical representation gives us a quick idea of students' gender-wise enrolment in major science subjects. The major science subjects we count here are mathematics and statistics, computer science, physics, chemistry, life science, and medical sciences. Taking these major science subjects as a whole, we can see that boys occupy a major share of seats as per available gender-wise data. Every year, boys more or less double the number of girls in these subjects. The number of girls never reached par with their counterparts in science subjects in university. These statistical data lead us to the point that we saw in earlier studies that science is a male-dominated domain of knowledge. This graphical data can only give us a glance and an overall idea of the gender gap in science.

<sup>13</sup> The source of the data is the annual reports released by the university from the academic year 2012-13 to academic year 2017-18. The data on Gender wise distribution of students' enrolment in different subjects are available only since the academic year 2012-13.

To substantiate this point, we also need to look at each science subject we already counted above separately. Such a microanalysis is also required apart from this macro analysis.

The following table gives the gender-wise distribution of students in the primary science subjects since the academic year 2012-13:

**Table 3.3 Gender-wise distribution of students in major science subjects<sup>14</sup>**

| Subject / year                      |       | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 2016-17 | 2017-18 | Total |
|-------------------------------------|-------|---------|---------|---------|---------|---------|---------|-------|
| <b>Mathematics &amp; Statistics</b> | Boys  | 443     | 103     | 106     | 100     | 102     | 87      | 1237  |
|                                     | Girls | 100     | 45      | 47      | 19      | 13      | 36      | 492   |
| <b>Computer science</b>             | Boys  | -----   | 347     | 328     | 298     | 265     | 304     | 1191  |
|                                     | Girls | -----   | 71      | 86      | 103     | 112     | 99      | 548   |
| <b>Physics</b>                      | Boys  | 190     | 207     | 208     | 254     | 157     | 161     | 1211  |
|                                     | Girls | 53      | 68      | 70      | 162     | 53      | 49      | 590   |
| <b>Chemistry</b>                    | Boys  | 227     | 220     | 200     | 159     | 157     | 183     | 1134  |
|                                     | Girls | 60      | 65      | 73      | 54      | 63      | 66      | 627   |
| <b>Life sciences</b>                | Boys  | 305     | 314     | 277     | 240     | 237     | 238     | 991   |
|                                     | Girls | 195     | 212     | 222     | 203     | 214     | 235     | 536   |
| <b>Medical sciences</b>             | Boys  | 72      | 82      | 92      | 83      | 73      | 65      | 1038  |
|                                     | Girls | 84      | 87      | 92      | 86      | 81      | 86      | 571   |
| <b>Total</b>                        |       | 1729    | 1739    | 1801    | 1761    | 1527    | 1609    |       |

The mathematics and statistics schools, computer science and information sciences, and chemistry are single-discipline schools. The physics, life sciences, and medical sciences are multi-disciplinary schools. The school of physics includes the Centre for Advanced Studies in

<sup>14</sup> The source of the data is the annual reports released by the university from the academic year 2012-13 to academic year 2017-18. The data on Gender wise distribution of students' enrolment in different subjects are available only since the academic year 2012-13.

Electronics Science and Technology (CASEST), the Advanced Centre of Research in High Energy Materials (ACRHEM), and the Centre for Earth, Ocean, and Atmospheric Sciences (CEOAS). The school of life sciences includes the Department of Biochemistry, the Department of Plant Sciences, the Department of Animal Biology, the Department of Biotechnology and Bioinformatics, and the Department of Systems and Computational Biology. The school of medical sciences includes a center for health psychology and a center for neural and cognitive sciences.

We have already come across in the literature review that major science subjects such as mathematics, physics, and chemistry are male-dominated. And if women are present in science subjects, they tend to be clustered in biological sciences. When analyzing the university data regarding the gender-wise distribution of students in major science subjects, we have to admit that the same point is reflected even in the latest decade of the 21<sup>st</sup> century. Considering the enrollment in mathematics and statistics in the university in the last decade, we could find the number of boys is twice or thrice more than the number of women. The case of subjects such as computer science, physics, and chemistry are also not so different. In almost every subject, one can find a considerable gender gap in enrolment nearly every year. In a single year, the number of girls either outnumbered boys in enrolment or even reached a balanced level.

When we come to the life sciences and medical sciences, which come under the broad area of biological sciences, we can see many women students in the enrolling. In the case of life sciences, when we look at the pattern of enrolment for recent years, we can understand that each year the number of enrolments of women students is making a jump and it is moving towards a balanced level. Relatively, the total number of enrolments is higher in life sciences, and each year, the gender gap decreases and drives towards equilibrium in terms of numbers. The available data for the academic year 2017-18 in the above table shows that the percentage of women is almost 50% of the total enrolment.

The enrollment trends in medical sciences are slightly different from those of the rest of the subjects we discussed here. The data shows that the number of women enrolled in medical sciences outnumbered the number of boys in almost all recent years, or that the number of boys and girls was equal in some other years. Even though the total enrollment in medical sciences is comparatively lower, women have a fair share of the total seats.

From the above data and explanations, we are again reaching the point where society and educational institutions still reflect the idea that major science subjects are masculine and suitable for boys. Even if girls manage to break free from this preoccupation and gender socialization, they still have to travel miles to reach a society of science that treats both genders equally. The clustering of women in the life sciences and medical sciences underlines that only biological sciences are suitable for women.

### **Enrolment trends in Ph.D. courses in the university**

When a university is considered, research courses such as Ph.D. are important. Universities offer such research courses because they produce future scientists and subject experts in academia. Universities, especially those of national importance, provide extensive facilities for research activities. However, the university's social environment impacts the development of future scientists because the university reflects the socio-economic, political, and cultural factors of society. Thus, the problems we can see in society can also be seen in universities. This may affect the research students personally and academically, sometimes only certain categories of students. Therefore, it is necessary to understand the university research environment from a social perspective.

The university provides research courses under various subjects such as Ph.D. in Mathematics, Applied Mathematics, Statistics – Operations Research, Computer Science, Physics, Electronics Science, Chemistry, Biochemistry, Plant Sciences, Animal Sciences, Biotechnology, ACRHEM, Earth & Space Sciences, English, Philosophy, Hindi, Telugu, Urdu, Applied Linguistics, Translation Studies, Comparative Literature, Sanskrit Studies, Economics, English Language Studies, Dalit and Adivasi Studies and Translation, History, Political Science, Sociology, Anthropology, Regional Studies, Folk Culture Studies, Social Exclusion & Inclusive Policy, Indian Diaspora, Science Technology and Society Studies, Human Rights, Management Studies, Gender Studies, Communication, Dance, Psychology, Materials Engineering, Medical Sciences and Language Endangered Studies.

When we analyze the gender-wise distribution of students in integrated MSc/Ph.D. and Ph.D. programs since 2012-13,<sup>15</sup>

**Table 3.4 Gender-wise distribution of students in Ph.D. courses.**

| <b>Year</b>     | <b>Boys</b> | <b>Girls</b> | <b>Total</b> |
|-----------------|-------------|--------------|--------------|
| <b>2012-13</b>  | 1051        | 490          | 1541         |
| <b>2013-14</b>  | 1102        | 537          | 1639         |
| <b>2014-15</b>  | 1112        | 532          | 1648         |
| <b>2015- 16</b> | 1109        | 557          | 1666         |
| <b>2016-17</b>  | 1037        | 569          | 1606         |
| <b>2017- 18</b> | 1008        | 821          | 1829         |

As our respondents are research scholars doing their Ph.D. courses, we should look specifically into the total enrollment trends. The above table shows the total enrolment of students in Ph.D. courses in the last few years. Gender-wise enrolment data is available for courses as a whole only and not for each department or subject on the university website. From the available data, we could understand that the number of women in enrolment is neither outnumbered nor equal to their counterparts. The number of men, women, or the total doesn't show a steady increase; instead, it flips back and forth over the years. Even though it is so, we can notice the increase in total enrollment over the years. The total enrolment of 1541 in 2012-13 increased to 1829 in 2017-18. The number of women in research courses also shows this cumulative increase over the years; it increased from 490 in 2012–13 to 821 in 2017–18. The number of men's enrolment in research courses has shown slight differences each year, though it can be seen as declining. It was 1051 in the academic year 2012–13 and after a slight increase in the following years, it decreased and reached 1008 in 2017–18.

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<sup>15</sup> The source of the data is the annual reports released by the university from the academic year 2012-13 to academic year 2017-18. The data on gender-wise distribution of students in Ph. D courses are only available from the academic year 2012-13.

For this research, the respondents were selected from a single school of study that included multiple departments. The School of Life Sciences has been selected as the field for this research. The laboratory-intensive nature of the life science subject is one of the reasons for its selection as the field of study. The school of life science building includes 65 research laboratories, beside other teaching laboratories and other related facilities. Also, compared to other major science subjects that we already discussed in this chapter, the proportion of female students is relatively high in the school of life sciences. We can see an increased number of women in general and Muslim women in particular in the departments under the school of life science. In the recent past, we have witnessed the number of women enrolling in life sciences increasing and the gender gap in enrolment is decreasing faster, unlike in other science subjects. The School of Life Sciences was founded in 1977 with the vision of promoting interdisciplinary teaching and research. It was initially started with some Master's programmes and later expanded by adding research programmes.

### **The research site: School of Life Sciences**

The gender composition of the research scholars in the departments under the School of Life Sciences alone can justify its selection as the field for this research. There has been a gradual change in the gender composition at the school of life sciences over recent years. It has accumulated and become an important change in life science. To get a better picture of our research site, we have to look at the gender-wise distribution of faculties and research scholars in various departments under the School of Life Sciences.

First, let's have a look at the gender-wise distribution of faculties in the school of life sciences<sup>16</sup>.

**Table 3.5 Gender-wise distribution of faculties in Life sciences**

| <b>Department</b>     | <b>Male</b> | <b>Female</b> | <b>Total</b> |
|-----------------------|-------------|---------------|--------------|
| <b>Biochemistry</b>   | 12          | 3             | 15           |
| <b>Plant Sciences</b> | 14          | 4             | 18           |

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<sup>16</sup> The data on gender-wise distribution of faculties in the school of life sciences is obtained from the respective official websites of the departments and also from the latest admission prospectus 2021.

|                                                   |    |    |    |
|---------------------------------------------------|----|----|----|
| <b>Animal<br/>Biology</b>                         | 11 | 5  | 16 |
| <b>Biotechnology<br/>&amp;<br/>Bioinformatics</b> | 10 | 2  | 12 |
| <b>Systems&amp;<br/>Com. Biology</b>              | 3  | 2  | 5  |
| <b>Total</b>                                      | 50 | 16 | 66 |

The table above shows the gender disparity among the faculties in different School of Life Sciences departments. There is not a single department in the life sciences where the female faculties outnumber their male counterparts. In addition, the number of women faculty members is also minimal compared to the male faculties in almost all the life sciences departments. The data in the table shows that there are 50 male faculties in the school of life sciences and only 16 female faculties. The highest number of female faculty is in the department of Animal Biology. The statistical data reinforces that women lag behind men in entering science careers, even if they manage to access higher education and research in science, as we have already seen in the literature review part of this research. The table makes us think that the gender gap in science careers is still wide and visible. It also makes us question the efforts taken to solve the different basic problems and thus improve the condition of women in the scientific professions. It is of great concern that even at the end of the second decade of the 21st century, the gender gap is high in scientific careers and professions.

The current research scholars are the younger generation when compared to the faculties. Looking at their gender composition can help us understand how far women in science have benefited from the changes in society and social structure so far.



When we look at the latest data on the Ph.D. students in each department of the school of life sciences<sup>17</sup>, it is as follows,

**Table 3.6 Gender-wise distribution of research scholars in Life Sciences.**

| <b>Department</b>            | <b>Men</b> | <b>Women</b> | <b>Total</b> |
|------------------------------|------------|--------------|--------------|
| <b>Biochemistry</b>          | 24         | 39           | 63           |
| <b>Plant science</b>         | 36         | 45           | 81           |
| <b>Animal science</b>        | 28         | 45           | 73           |
| <b>Biotechnology</b>         | 23         | 41           | 64           |
| <b>Computational biology</b> | 2          | 5            | 7            |
| <b>Microbiology</b>          | 2          | 2            | 4            |
| <b>Total</b>                 | 115        | 177          | 292          |

The above table is derived from the analysis done on the latest list of total Ph.D. students obtained from the university's official website. The table shows the gender-wise distribution of students in various School of Life Sciences departments. There are six departments under the school of life sciences. When we look at the table, it clearly says that female students outnumbered their male counterparts in all departments under the school of life sciences. When we take the school of life science as a whole, we can see that the total number of female Ph.D. research scholars is higher than male research scholars. While analyzing the total list of Ph.D. scholars, it was also found that there are currently six Muslim women pursuing their research in the school of life sciences. The distribution of Muslim women research scholars in the life sciences is biochemistry-2, plant science-2, animal biology-1, and biotechnology-1.

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<sup>17</sup> The latest data on PhD students in each department of the school of life sciences are obtained from the list released by the university in its official website.

## **Part 2-The personal profile and family details of the respondents**

This section of the chapter will analyze the personal profiles of the respondents selected for the research. The details include the analysis of the respondents' personal backgrounds, emphasizing the region and family. Following is a sociological analysis of the family's educational, economic, and occupational background, and the respondents' educational journey. Finally, the session concludes with the analysis of the universal problems the respondents face as women and their unique experiences as Muslim women in the process of their educational journey from KG to Ph.D.

### **Respondent-1**

Ayisha is a Ph.D. research scholar at the Department of Plant Science in the Life Sciences. She comes from Kashmir. Her family consists of her father, mother, and siblings. Her siblings consist of one older sister, one younger brother, and a sister. Her father is a college graduate who is now employed as a teacher in a private school in Kashmir. Her mother is a housewife, and she is also illiterate. She didn't go to school in her lifetime. Even though her mother is illiterate, her mother supported and motivated her to pursue research outside of Kashmir when her father was uncertain about sending her outside of Kashmir for higher education. She expressed that she never felt any hindrance to her educational choices from her family side and she is the first person from her family to go for research outside of the domicile state. Her elder sister is married off, and her husband is a business man. Her elder sister couldn't go for further studies after marriage, and she is now a housewife and mother of 3 children. Her younger brother completed his higher secondary education and joined college for his engineering degree. Her younger sister is in her 9<sup>th</sup> standard now. Her elder sibling did not opt for science for higher education. But her younger siblings are pursuing their studies in science. She said everyone should be given the freedom to choose the area they wish to work on. She told her younger brother is good at athletics and sports, but her family told him to select science for his studies, and she felt bad and sorry about it.

Her schooling, up to her intermediary, was from Kashmir. It was from the private school her father was working at. She also attended a madrassa to acquire religious education. After her schooling, she joined Kashmir University for her under graduation. She completed her

undergraduate and joined Hyderabad Central University for her Ph.D. Though she completed her undergrad in her home state, she also got opportunities to visit other states as a part of seminars and conferences during her undergrad. She opted for a Ph.D. to acquire more knowledge and become an expert in her specialized area. She aspires to become a scientist. She also opined that everyone should study science at least at their intermediate level or graduation because it gives necessary knowledge. And if we wish to change our stream of study to arts, we can do it, but can't do it otherwise, shifting to science at the higher level from a non-science background. She cited an example of her friend who turned to philosophy from science research.

Her father is the only earner in the family. But they have enough financial stability from the income of her father. She is also availing financial assistance from the university for her research. So, she can cover most of her academic and personal expenses with it. She is also getting financial support from her family. Her family belongs to the middle class when we look at it from an economic perspective. She is not yet married and wishes to continue her education even after her marriage and secure a career in science.

## **Respondent 2**

Hafisa is a research scholar at the department of animal science in the school of life sciences. She is also from Kashmir. Her family consists of her father, mother, and four older brothers. Her father is a private textile shop owner and his educational journey was only up to the 5<sup>th</sup> standard. Then he joined his father, who had a textile shop, and took it as his own after his father's death. He was the only son of his father, as his mother died while giving birth to him. Her mother is a housewife. Her mother only had a Madrassa education, which is religious in nature. Her older brother struggled in school and was a failure as an intermediary. So, he joined his father in the textile shop, as their father is also old now. Her second-eldest brother has always been a good student and currently works as an engineer in another country. He is working as a civil engineer for a private company in Dubai. Her third older brother works as an Assistant Professor at a private college in another country. All of her brothers got married. The elder brother and his wife, and their four children, are settled in their own new home in Kashmir. Her second brother and his wife, an engineer and whose family is settled in Dubai, along with their two children, are settled in Dubai. They visit Kashmir whenever the couple are allotted holidays from their

respective companies. Her third elder brother and his wife is post-graduate preparing to pursue her higher education. She lives with the respondent's parents.

Her schooling up to the 10<sup>th</sup> standard and the Madrassa education was from a private school in her hometown. She joined another government school for her intermediary school as the school had better infrastructural facilities such as laboratories, especially for science subjects. She graduated from a private college in Kashmir and her post-graduation from Kashmir University. Then she joined Hyderabad Central University for her PhD. She wanted to continue her education in a well-reputed institution of national importance. She thought it should be outside of Kashmir because she had enough ideas and experience about students' problems in their education in Kashmir.

She is from an upper-class family. Her father and all of her brothers are working. One of her sisters-in-law is also employed. Though her brothers are married and have their own families, they still financially support her and her parents whenever needed. As she is the youngest child in the family, she never felt any financial crisis in her educational journey.

The above two respondents are from Kashmir, as I already mentioned above. This regional factor has influenced their experience of the educational journey as well. Kashmir is a place that stands out from the normalcy that we can witness in any other state in India. Kashmir, unlike any other Indian territory, has been subjected to numerous military occupations and disputes. Kashmir is one of the world's most heavily militarized areas. The ongoing wars in Kashmir, and the people's resistance to state and military atrocities, have resulted in a state of siege that subjects the entire population to constant surveillance, punishment, and control. This has disrupted their daily routine in every way. Education is one of the most severely harmed sectors as a result of these disputes. According to studies on the effects of these conflicts on education in Kashmir, many working days have been lost due to frequent strikes and curfews.

As a result, the quality and efficacy of education have decreased in recent years. Many students have dropped out of their courses in the middle due to interrupted schooling or a lack of funds, while others have relocated to other parts of India or abroad. Apart from academic issues, co-curricular activities such as student unions and debate forums were not functioning in educational institutions. Thus, it is clear that students were not given any chance to participate in

the decision-making processes at any level (Hassan, 2012). Another investigation discovered that many schools and other educational institutions are either under direct military control or are in close proximity to the military. Military personnel were used to make derogatory remarks or obscene gestures to students. In residential areas, army personnel caused sexual violence, insecurity, abuse, and other forms of harassment, with girls being the most vulnerable to negative consequences of the militarization of educational spaces. As a result, the dropout rate among school-aged children, particularly females, has increased (Ahmad, 2014). As a result of these circumstances, there is a gender disparity in education, a low literacy rate, and consequent unemployment in Kashmir.

This regional background has so affected the respondent's school and college days. They also witnessed many curfews and lockdowns due to the conflicts in Kashmir, which adversely affected their school education. They missed their working days and sometimes their schools could not conduct examinations. Communication and transport facilities were restricted, which troubled the functioning of educational institutions. People were afraid to send their children, especially girls, to schools and colleges because of the reports of sexual assaults on women. Many of their friends have left the schools and colleges in the middle of the way. They didn't face any such traumatic incidents, but came across stories of violence happening to women in various parts of their state, which were terrible. They were able to move forward in their educational journey because of the support and courage given by their family. Their families were proud of their educational achievements. Despite the disapproval of their relatives and neighbours, their parents send their children to college.

Both of these respondents have migrated to another part of the country to pursue their higher education. But their Kashmiri identity invited trouble even there. They had to defend their Kashmiri identity during admission and throughout the course. Though they are meritorious, with excellent graphs of success in almost all of their educational degrees and having enough qualifications for the course, the faculty and staff is kept in doubt. Because the faculties and staff think that these students may sometimes be unable to continue their course due to the conflicts that may happen in Kashmir. The faculties are also reluctant to send them to Kashmir in vacation as they fear they may not return if some conflict happens. The communication and transportation restrictions in Kashmir sometimes left these Kashmiri students unable to reach their families,

which put them under mental and emotional pressure that also showed up in their academic and personal lives.

### **Respondent 3**

Amina is a research scholar in the department of biochemistry. She is basically from Bihar but later shifted to Delhi because her parents are aged and have health issues, so in order to get better treatment and hospital facilities, they moved to Delhi. In Bihar, her home was in a remote village without most of the facilities for education, health care, etc. In Delhi, they have relatively better access to these facilities. Her family shifted to Delhi when she was in her 2<sup>nd</sup> standard. Her family consists of her father, mother, 3 older brothers, 2 older sisters, and herself. Her father is a vegetable and fruit vendor. He also owned a shop in the same area. Due to health issues and difficulties, he is not working anymore. Her mother is a housewife and only had a Madrassa education. Her mother's family was so religiously orthodox that they only gave importance to her mother's religious education and that too until her mother got married. All of her siblings are married and settled. Her eldest sister is settled in Bihar with her husband and children as she got married before they shifted to Delhi. Her eldest sister only had a Madrassa education and a school education up to the 10<sup>th</sup> standard. Her eldest brother finished his schooling up to the 10<sup>th</sup> standard at a government school in Bihar and then joined some of the relatives who had businesses, and now he has his own business in Bihar. He grew into a successful entrepreneur. He married an orphan girl among his relatives, as it was regarded as a good deed from the religious aspect. She had only a Madrassa education, which was left unfinished as she lost both of her parents when she was too young. Her second elder brother finished his schooling in both Bihar and Delhi. He completed his graduation in commerce, and now he is working abroad in the commerce field as an accountant. He is married and settled with his wife and children abroad. His wife went to school up to the 10<sup>th</sup> standard and is now a housewife. Her second-eldest sister completed her Madrassa and school education up to the 10<sup>th</sup> standard. After she got married, she got the opportunity to become a Madrassa teacher via her husband. Her youngest elder brother's schooling was also from Bihar and Delhi. Then he completed his graduation and post-graduation from a private college in Delhi. Now he is working as an assistant professor at a private college in Delhi. He got married recently, and his wife is about to complete her post-graduation degree in Delhi.

She is the youngest child in her family. She is the only one to pursue research in science in her family. She did her schooling up to the 2<sup>nd</sup> standard at a government school in Bihar and then shifted to Delhi. She completed her secondary education at a government school in Delhi before enrolling in an undergraduate programme at Jamia Millia Islamia University. After completing her undergraduate course, she came to Hyderabad Central University for her Ph.D. course. She said she is so proud and optimistic about science because she believes science can help people. Her area of research is biochemistry, and it is a branch where scientists can contribute to developing medicines to cure diseases. She said she would love to serve the poor and needy people in the world, especially suffering from the financial crisis. She thought that there was no point in developing medicines and all that, which were so costly when it came to the poor people, because they couldn't access them. So, she says people should work in this field and thus benefit the needy and poor with the accessibility of such developments. She sees her science research as a better way to reach out to the poor to provide them with the benefits of such scientific research. She opted for her university for her higher education based on the better laboratory facilities.

She belongs to a middle-class family. Her siblings are all settled with their own families in separate houses, except her youngest elder brother, living with their aged parents in Delhi. All of her siblings are in stable financial condition to financially support her educational journey. She is not yet married. She also won the Maulana Azad National Fellowship for minority communities to pursue research. So, she is also financially independent. The fellowship enabled her to support her parents financially, as her aged parents had a lot of hospital expenses to meet.

#### **Respondent 4**

Khadeeja is a research scholar at the department of biotechnology in the School of Life Sciences. She is from Bhubaneswar, Odisha. Her family consists of her father, mother, brother, sister-in-law, and herself. Her father completed graduation and has enough business knowledge and experience that he got from his father. He is a businessman based in Odisha now. Her mother completed her school education up to the 10<sup>th</sup> standard along with a Madrassa education. After marriage, she stayed as a homemaker. Before enrolling in a private college for his engineering degree, her brother attended a government school in Bhubaneswar until the 12th grade. Now he is settled in Hyderabad with his job in the information and technology field. He is a software

engineer for a multinational company in Hyderabad. Her sister-in-law is a B.Tech graduate, settled in Hyderabad with her husband and searching for a better job opportunity.

She did her schooling and graduated from her domicile state. She went to a private school up to her 12<sup>th</sup> standard and then joined a government college for her undergrad course. After completing her undergraduate, she came to Hyderabad Central University for her Integrated MSc-PhD programme. She said she had been interested in science since her school days. She wished to become a scientist. Her father instructed her to secure a medical seat during her intermediate days. Soon after completing her intermediate, she even tried but couldn't make it into any government medical colleges. And it was challenging to try it in private institutions as they are much more expensive, so she was not interested in going for it. So, she joined for her bachelor's degree in her state only. During the last year of her college days, she shared her concern about higher studies and her plans to become a scientist to her best friend. Her best friend suggested her to look for premier institutions in the country, such as central universities, to continue her higher education and research, which could help her realize her dream. She is a very studious girl, even from her school days, and is still doing her best in research. She always managed to perform well and score high in her subjects. So, she began to search over the internet with the help of Google and other websites about better higher education and research opportunities and campuses providing the same. And she found an interest in various premier educational institutions in the country. She stated that she attempted the entrance examinations for almost all major central universities for her master's degree. Finally, she got admitted to the university for an integrated masters and Ph.D. program.

She belongs to a middle-class family. Her father and brother are both working now, and her family is financially secure. She also secured financial assistance from the university to help her meet her personal and academic expenses. Besides, she receives financial support from her father and brother.

### **Respondent 5**

Shakira is a research scholar at the department of biochemistry in the School of Life Sciences. She is from Hyderabad. Her family consists of her father, mother, a grandmother from her father's side, an elder brother, and a younger brother. Her father completed his 10<sup>th</sup> grade and



now works as an office clerk at a government office in Hyderabad. Her mother is a housewife. Her mother completed her intermediate and was not interested in pursuing higher education, so she opted to stay home. Her elder brother completed his schooling at a private school in Hyderabad and secured an engineering seat at a private college in Hyderabad. Her brother now works as a civil engineer for a private company in Mumbai, Maharashtra. Her brother got married to his colleague, who is also from Hyderabad. The couple are now settled in Mumbai. Her younger brother did his schooling at the same private school as her elder brother and is currently graduating from a private college in Hyderabad. They have given less importance to madrassa education. But all of them have attended a madrassa for some time.

Her schooling was also at the same school where her brother studied. After completing her undergraduate and post-graduation from a government college in Hyderabad, she joined Hyderabad University for her Ph.D. course. She belongs to a middle-class family. Both her father and brother are adding income to her family. She never felt any financial shortage for her educational purposes throughout. She also bagged a scholarship for her research. So, it is easy to cover her academic and personal expenses. Her grandfather died of cancer. At that time, they had little idea about cancer. So, she grew interested in studying cancer. Her research is related to cancer. She opted for Hyderabad University because she found better laboratory facilities and excellent faculty to enrich her research interests. She married two years ago and moved to Hyderabad with her husband, who works for a logistics company. They are living in a rental flat near the university campus.

### **The Economic Capital**

Financial ability is a significant factor in educational success. Merit does not always work wonders. Many deserving pupils are denied access to a high-quality education due to a lack in financial resources. Using Pierre Bourdieu's conceptual framework, we can examine the relationship between economic status and education. According to Bourdieu, "capital is accumulated labour (in its materialized or incorporated, embodied form) that, when appropriated on a private, exclusive basis by agents or groups of agents, allows them to appropriate social energy in the form of reified or living labour." He went on to say that capital can take three different forms. First, as economic capital, this can be converted into money instantly and directly and formalized in the form of property rights. Second, cultural capital, can

be converted into economic capital under particular conditions and institutionalized in the form of educational qualifications. Finally, social capital is made up of social duties or relationships. It can be codified in the form of a title of nobility if certain prerequisites are met (Halsey, 1997).

From the personal profiles of the respondents, it is clear that they belong to the middle or upper class of the economic structure of society. By connecting academic success, Bourdieu examined the differential scholastic achievement of students from different social classes. This refers to the distinctive academic profits that children from various classes and class fractions can achieve, and the distribution of cultural capital throughout classes and class fractions. The scholastic return from educational action is determined by the family's prior investment in cultural and economic capital. Family assistance of both kinds has aided the responders in progressing further in their schooling. It was evident from their story that their parent's generation had lower educational accomplishments than them, which we can attribute to their grandparents' economic and cultural capital investment in their parents' education. All agents lack the financial and cultural capital to continue their children's education beyond the bare minimum required to reproduce the least valuable labour force at any given time. Under specific conditions, cultural capital acquired in the form of academic qualification can be turned into economic wealth. As a result, this cycle reproduces the social class system. Even though the respondents' parents did not have much cultural capital to invest in their children's education, the respondents were able to convert it into both cultural and economic capital through the use of economic capital. They are now able to invest both cultural and financial resources in future generations. So, an intergenerational change is also happening in the process.

In the realm of education, there are a number of universal challenges and problems faced by women in general, and Muslim women in particular also face unique struggles. It means being a woman and being a Muslim woman simultaneously is a double burden one has to go through. Many of the facts shared by the respondents have shed light on them. Let's have a look at these universal and unique challenges faced by women from the experience of the respondents.

## **The universal problems of women and the unique challenges of Muslim women in education**

For a woman, the main challenge with regard to education is the struggle to get access to education. From the narratives of the respondents, this is true about their mothers. Most of their mothers had no access to formal education. For Muslim women, as the orthodox religious family gives primary importance to the religious education provided by the madrassa, access to school education remains unachieved. In the case of women, who are given the freedom to access school education, it was influenced by certain factors. Parents are reluctant to send their children to schools or colleges far from their homes. The availability of a school or madrassa in their home village or nearby places is a criterion they use to decide whether to send their girl child for education. The transportation facilities available have also had an impact on girls' education. Especially for Muslim women, there are certain restrictions and conditions to consider while they travel according to religious rules.

From the conversations with the respondents, it was found that the distance between their home and the university was a matter of great concern for the parents and families of certain respondents, because most of them had never been outside of their home state. Her parents were aged and her mother was suffering from various health issues; it was difficult for her to leave them. As she was the unmarried and youngest child in the family and all the other siblings were married off and settled with their own families, she always felt it was her duty primarily to take care of her parents. She felt she should be with them many times. She had a tough time deciding on her career. It has a social and religious perspective. Because the responsibility of taking care of the family members is up to women, as per the gender roles. Also, in Islam, serving the aged parents is a great deed.

An incident was cited in "Hadith"<sup>18</sup> regarding this. One man was about to join the war, and the prophet asked him whether he had aged parents at home. When he said yes to the prophet's question, he was instructed to return home and serve his aging parents. Because helping one's aged parents is considered the greatest deed, rather than defending one's religion and people by participating in the war. So, for some of them, leaving their home were a tremendous emotional

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<sup>18</sup> Hadith can be defined as the collected traditions of the Prophet Muhammed, based on his sayings and actions.

challenge, as it was their comfort zone. They felt their parents were also equally emotionally disturbed, or even more so. One respondent stated that her parents were terrified of sending her to university, which is so far away, for fear of her safety. The parents' fear was reflected in the increasing number of sexual assaults and physical violence against women in various parts of the country.

And, in the case of a Muslim or Muslim woman in the country, their tensions were heightened because they had already witnessed many hate crimes against Muslims in general and Muslim women in particular, in their hometown and many other parts of the country. Being from a minority community was a kind of fear in certain walks of their lives. The infrastructural facilities available in the educational institution, especially those related to personal hygiene and residential facilities also influenced women's education. The availability of female teachers and staff could also impact women's education. Also, the company of peer groups or siblings in educational institutions had an impact on women's education. Because parents were reluctant to send their girl children to the educational institution if there were nobody to accompany them. The economic and cultural capital of the family leaves a major voice in women's education. The financial stability is a major criterion for the children's education in that family. And if the family only can educate one child, the family will opt for male over female for schooling. This results from the accumulated gender discriminatory practices deeply rooted in a patriarchal society like India. These patriarchal factors also influence the choice of women's education. The female had no voice or power to decide their education. They had to obtain the consent of the elderly male member of the family, who may also be the family breadwinner.

The economic dependence of women has made them voiceless regarding education most of the time. The Muslim community in India's educational and economic backwardness has left them with relatively less economic and cultural capital, which is reflected in the deplorable state of Muslim women's education. The societal expectations of gender roles are another hindrance in women's education. The bundle of household work and responsibilities leaves women with a shortage of time for academic purposes. It gradually results in the unproductivity of women in their academic field. The extra responsibilities that come with marriage will force women to completely discontinue education or take a break from academic activities.

Because of the Muslim community's low marriage age, Muslim women dropped out of school at a young age. A prevalent tradition that we can see exists in India is that women leave their homes and shift to their husband's home after marriage. This migration can also lead to the dropout or discontinuation of women's education due to transportation difficulties. In Indian culture, motherhood is considered a sacred idea, in front of which education hardly gets any attention. Maternity may force women to ignore their academic activities either entirely or partially.

The family is not the only factor that can influence the decision-making process, especially when it comes to the higher education of girls. Some of the respondents shared their experiences regarding this. One respondent said that people in her neighbourhood are even scared to send their children, to school and higher education, especially female children. These neighbourhood people also tried to tell her parents not to send her for higher education after graduation. But her parents were so proud of her achievements in education. So, nothing couldn't stop them from sending their daughter for further higher studies and research. Even though the family members supported their daughter's going for higher education, there were a lot of relatives who blamed the parents for giving their girls this much freedom and the child as well for not getting married. For some relatives of a respondent, the distance was the primary reason for discouraging her parents from sending her for higher studies. She said they also tried to scare them by telling different stories of children who went to faraway places and universities for higher studies and faced various struggles and issues.

The stories of inter-religious or inter-caste marriages among university students and their relatives and other people ignited fear in parents. They were discouraged by the people around them from sending their children for higher education far from their homeland. There are empirical studies that explore the changing forms of marital choices and types of marriages on university campuses. The study argued universities offer a social space where students from different multicultural backgrounds are exposed to different ideologies, educational practices, and cultural practices. Here, the marital choices of both men and women on the university campus undergo considerable changes. The study also found that both male and female university students generally support inter-caste and inter-religious marriages (Ramsheena &

Nagaraju, 2015). So, this can be seen as an empirical basis for fear of parents regarding their daughters being sent for higher education, even though it applies to males and females alike.

The activities and interactions of women in educational institutions are under the surveillance and regulation of the societal norms of gender roles. For Muslim women, along with the general societal guidelines on do's and do not's based on gender, there are also religious guidelines to be followed. Generally, the interactions between male and female have been policed in the name of morality in India. Society places many restrictions on the behaviour and interactional patterns between men and women. This can influence the relationships women have with their friends and teachers and their participation and involvement in the activities taking place as a part of their education. It is reflected in women's personal and academic lives in general and Muslim women in particular. The advantages of formal and informal interactions within an educational system have a far-reaching effect on educational achievements. Due to the restrictions on women's interaction, they cannot take advantage of the formal and informal relations and interactions with their fellow students and faculty.

### **Summary**

This chapter looked at the general condition of women students at the university. The enrolment trends and gender-wise distribution of students over various subjects relevant to the research have been analyzed. The chapter also justified the choice of the research field by highlighting how it is different and stands out from the rest. The second part of the chapter gave detailed notes on the personal profiles of all five respondents to the research. The socio-economic and educational background has been conceptually and theoretically analyzed. Finally, the universal problems faced by women and the unique challenges faced by Muslim women in their educational journey were discussed.

## **Chapter 4**

### **LIFE IN THE LABORATORY: UNDERSTANDING THE ACADEMIC AND PERSONAL LIFE OF MUSLIM WOMEN RESEARCH SCHOLARS IN SCIENCE**

#### **Introduction**

This chapter will analyze the personal experiences of Muslim female research scholars to understand the issues and challenges they face in everyday research life. The patterns of formal and informal relations with the faculties and fellow research scholars are analyzed systematically. The complexities of the experiments and time factors will be considered while looking into their laboratory life. The relationship between their professional expectations and gender performances will be emphasized in analyzing how they negotiate between personal and academic/professional life. The chapter will also try to pay attention to the everyday challenges faced by the respondents as practicing Muslims.

#### **Life in the Laboratory**

An intensive laboratory experiment is the defining feature of the scientific mode of knowing the world. We have selected the school of Life Sciences as the research site which is not an exception. The School of Life Sciences building includes around sixty five laboratories to facilitate research work. The following sessions deal with different aspects of the laboratory-oriented research lives of the respondents.

#### **Topic and Supervisor Selection**

Along with the admission procedures, the research area and an appropriate supervisor who is specialized in that area are chosen. According to the research area, every candidate has to submit their resume with three choices of preference of faculty members ties whom they wish to work with. The department allows the supervisor to the candidates based on their preferences and performance in the admission test and interview. Ayisha, one of the respondents, recollects her experience with the selection process and admission procedure. As her first preference was a female faculty member who is a senior professor in the department and very close to her area of research and is also from the Muslim community, she felt like the other panel members were not considering her during the personal interview. She felt like they were a bit intolerant towards the

above-mentioned female faculty. Other faculties behave like a dialogue between her and that female faculty member she preferred. They didn't even have any questions for her, and they were like, "Let that faculty member deal with it." In other words, to be a little more specific, the attitude of other faculties was like this: the candidate is a Muslim woman and the faculty is also a Muslim, so let them only deal with it within themselves. She added that despite the reputation of that lady faculty in the department, other faculties were showing a kind of ignorance towards her. Even in the twenty-first century, she believes, there is male dominance in science. The identity factors of the candidates, such as gender, religion, and region, have influenced the selection of supervisors.

The faculties asked the respondents they approached whether they were serious about the research and whether they would be continuing the research until its completion. She was also offended by the faculty's comment that women will join research and perform well initially. Then they will get married off and either discontinue research or see their performance and productivity in research decline. This reminds us of the observation in the Sachar committee report (2006) that there is a common belief that Muslim parents feel that education is not important for girls and that it may instill a wrong set of values. Even if girls are enrolled, they are withdrawn early to be married off. This leads to a higher drop-out rate among Muslim girls. But the interactions with people from the Muslim community indicate that the problem may lie in the non-availability of schools within easy reach for girls at lower levels of education, the absence of girl's hostels, the absence of female teachers, and the availability of scholarships as they move up the education ladder.

One of the respondents recollected how she convinced the faculty about her commitment to research. She was kept in doubt because of her regional identity. As she belongs to Kashmir and there are a lot of uncertainties prevailing in that state, the faculty doubted whether she would be able to pursue and complete her research. She understood the reluctance of the faculties to supervise her research. She felt terrible because her identity mattered more than her merit and qualifications.



### **Relationship between Research scholar and Supervisor**

While choosing the research supervisor, a significant thing to be noted is that the faculty should have enough funding to hire students for research projects, as the expenses for research are much higher. Even with low funding, the faculties won't reject students sometimes. They take them, but later, it troubles the researchers. Because the faculty doesn't have enough funds, they can't buy and provide the necessary chemicals and equipment needed for the research as per the requirements of the students. It leads to the delay of the research as well. The relationship between the supervisor and the research scholar has a major influence on how the research is carried out and its results. The formal and informal relationships with the supervisor can affect the research in different ways.

Most research scholars in science have to submit a progress report on their research work weekly or monthly, which may vary depending on the supervisor. One of the respondents said that it doesn't matter if the researcher gets negative results. They need to present it before the supervisor as lab reports. She said convincing supervisors about the need for certain chemicals for experiments is tough. If the supervisor is convinced, they will move ahead to get it if it's not already available in the lab. And certain chemicals take a long time, sometimes months, to get, so the experiment is delayed. But even these delays cause unsatisfactory feedback from the supervisor. She also added that the necessary chemicals might be available in other labs under the control of other faculty. They may get it from there without waiting for the fresh arrival of the chemical. But most of the time, faculties don't make requests to get necessary chemicals from other labs due to clashing relations between the faculties.

One of the respondents believed that proper communication with the research supervisor is important in this kind of situation because the supervisor is the one who can help them with these kinds of issues. The formalities that take a long time to get processed and accepted by the academic authorities are troublesome for the researchers to carry on their experiments on time. Sometimes, even when the communication is done correctly, it takes a long time to get sanctioned by higher authorities and get done with their requests for chemicals or other equipment facilities to be finally provided. So long as their required things are not provided, they can't take forward their research.

Khadeeja joined her research course with high expectations, but reality had hit her very badly. The major problem she faced was a troublesome relationship with her supervisor. She explained in detail that she started her research, and after a few months, she began to feel so much pressure and stress, and at the end of the day she felt exhausted. She began to feel like she couldn't continue her research under the supervisor. Her supervisor was putting her under a lot of stress about her work. She could no longer do her work peacefully. She stated that her supervisor was extremely demanding about her work daily, even though she was aware that some tasks could take days or weeks to complete. Her supervisor also gives her extra work like reviewing articles which only benefits her supervisor.

Apart from the exhausting lab sessions that began as early as possible in the morning and ended as late as possible at night, these extra works were a torture for her. Of this pressure, she found out that she couldn't even complete her simple lab work or her own readings and things. It began to affect her daily life, slowly affecting her mental and physical health. Along with this pressure, she began to develop health issues as well. So finally, she decided to change her supervisor and continue her research under another supervisor. She approached her supervisor so politely with this request. But her supervisor was not happy with this request, and as her supervisor holds a powerful position in the department, it became difficult to proceed with this request further. Her supervisor opposed the request and told her to step back from changing the supervisor. But she was very sure about her decision that she couldn't continue research like this. So, she told her supervisor that she only had two options: first to change the supervisor, and second to quit her Ph.D. She was shocked to hear the replay from her supervisor that her supervisor told her to leave her Ph.D. then. She was devastated and in great mental tension because it was so shocking to hear from her supervisor to quit the termination of the course without any mercy or consideration. She couldn't think about leaving the course because it was almost her one and a half year of the Ph.D. course.

She then talked to some other faculty from her department about all these issues. She said they were very understanding and supportive and instructed her to raise a complaint in the grievance cell. So, she raised her issue and requested a change of lab and supervisor in front of the cell. But her supervisor was also a part of the grievance cell. And she felt that her supervisor tried to interfere with the activities of the grievance cell on her issue. So she demanded just and

transparent action from the grievance cell by keeping her supervisor away from the decision-making process. She was called and given a chance to explain herself regarding the issue. But she desperately said that her supervisor had never attended the meeting held by the grievance cell. The cell constantly tried to negotiate between the two, but she told her supervisor had an arrogant attitude. During this time, she was literally in trauma because she didn't belong to any laboratory. She couldn't carry on her research during this time, which was around three months. She said she neither belonged to her old lab nor any new lab. She couldn't tell her family or parents because she was afraid, they'd freak out. She doesn't want to trouble them with this issue. So, she tried her best to act as normal as possible whenever her parents called her. She said a prayer to God was the only relief she had had during those days. And the other faculty in the department who stood by her side also felt a great relief for her. Somehow, she got through this terrible period of her research life. After a lot of negotiations, her supervisor accepted her request to change the lab and continue her research under the guidance of another faculty member. Now she is happily continuing her research.

Now she is under the guidance of a Muslim faculty member in the department who also stood by her side throughout the struggles she had gone through. So, she also faced certain comments, like she had all these troubles with her earlier supervisor because that supervisor was a non-Muslim, and she opted for the new supervisor because he is a Muslim. She said people even told her new supervisor the same comment. But she is sure about why she chose that particular faculty member as her new supervisor because he was working in her field of study. That was the sole reason why she opted for him. But she said fellow researchers and some members kept saying these kinds of comments.

This incident better explains the role of a supervisor in the academic and personal life of a research scholar. From this experience, we can understand how the power relations between a research scholar and supervisor should be and should not be for a positive research atmosphere. From a theoretical aspect, we can contextualize these kinds of experiences of scholars with the idea that knowledge, power, and education are interlinked concepts. And this is a reflection of the power structures in society at large, so understanding this can also throw light on the existing power structures. German sociologist Karl Mannheim highlights the importance of passive and active learning, ranging from instinct to habit, from expressing oneself through language to

understanding cultural symbols. Mannheim also focuses on the relationships between educational agencies, teachers and pupils, students, and class and school. It underlines the importance of structuring institutional times and relationships through the school system's organization.

### **The relationship of Research Scholars and Fellow Research Scholars**

Apart from the relationship with the supervisor, another kind of relationship that can influence the research activities and personal lives of the research scholar is the relationship with fellow research scholars. Here, the informal network among the scholars itself helps them find each other. They borrow chemicals from the labs to save time and get their work done without stressful formal interactions with faculty. One respondent felt that it is good to have a healthy relationship with the supervisor and fellow researchers, whether formal or informal. It can help with the research in many ways. But she rarely seeks help for her study from fellow researchers because she feels a kind of insecurity. She thinks that if something goes wrong in the research, she may be suspicious of those who helped her. If she does it all alone, such a doubtful situation can be eliminated. She will not feel guilty or blame others for anything wrong with her research. She said even though the chemicals and other materials needed for the research take a long time to get approval and delivery, they will know how much they have to use, so how much it will be necessary. Hence, they always try to keep it pre-ordered accordingly so their flow of research will remain uninterrupted.

The fellow researchers helped the respondents lift heavy chemical containers, operate the equipment, and so on with her friends. They also have assistants who work in the lab to help them with all of these as well. But they may not be available all the time, so even though the lab assistants are not available, they can manage with fellow researchers. As a result, the scholars benefit from good relationships with fellow research scholars from their own laboratory those from other departments and laboratories.

### **Laboratory experiences**

Laboratory experiments are a major part of scientific research. It consumes a lot of time and energy for research scholars in their everyday routines. One of the respondents said that sometimes it is so scary to be alone in the lab and manage it. She also worked in the lab alone at

night when nobody else was there, but sometimes they asked their friends or neighbour lab mates to stay there waiting for them. Because of the deadlines, they can't postpone their work in the lab. So, on some days, it becomes too late in the night to return from the lab, and they lack enough time to rest, which makes them feel exhausted physically and mentally. The faculties sometimes don't allow other people to enter their labs out of fear of any damage to the equipment and other items in the lab. It even affects them in terms of borrowing chemicals or using equipment from neighbouring labs. Unlike other students at the university, they don't have a proper Saturday and Sunday holiday in the week because they have to go to the lab even on the weekend days.

The respondents kept talking about their laboratory experiences. The laboratory experience is all about the hard work they have to do. They have to spend a lot of hours doing the experiments during their days, and sometimes it takes a lot of time and effort to complete a single experiment, and they can't be assured of positive results. If the result turns negative, they have to repeat the experiments. This situation gives them pressure from the research supervisor, because they have to update the results of experiments and can't meet the expectations of the research and research supervisor as long as they get positive results from their experiments. The unavailability of chemicals and other equipment facilities in the laboratories further delay their work and, thus, results. When they are late getting out of the laboratory, going back to the hostel alone is also scary as there are a lot of stray dogs and other animals, such as wild buffalos, wandering inside the campus.

Sometimes she asks any of her friends to wait for her to go back to the hostel to finish the research work in the laboratory. Those scholars living outside the campus with their spouses can't stay at the laboratory late at night. Sometimes their spouses come to pick them up from the campus and take them home, or else they have to depend upon taxi services.

The major pressure or stress they get is from the research work they are carrying out. Apart from this, certain factors can add to their focus. When their respective departments host conferences, seminars, or other events, it is not only the faculty and staff who get assigned to organize and coordinate the events, but also these research scholars. So it takes their time and effort, which has a negative impact on their ongoing research work. One respondent said that she was also part of the coordination committee to conduct seminars and conferences in her department. They had

annual events hosted by their department. She said they had to work on it for around two months, keeping aside all their research work and other personal engagements. They had to make lists of the participants, send them a mail with the details and updates of the events, prepare an abstract book, and so on. Even though this kind of extra work takes their time and energy and affects their research in the short term, she said these events also have a positive side. Because she believes that this kind of event organization will help them in many ways. If they become faculty, this experience will help them conduct such events. Another benefit is making personal contacts with reputed people in the field of their research who come to participate in the events. She thinks it may help them in the future if they move ahead in further research or professions as well. And of course, it adds to their resume, which will help them in the future. But even though women research scholars are ready to take on these kinds of responsibilities, the supervisors in some laboratories prefer only male scholars to assign such extra work as they feel if they assign women scholars, they may not be able to do it well because of various womanly problems and women scholars may come up with various excuses. So, because of being a woman, the scholars will lose many such opportunities, which will also be beneficial in the future. Their ability is doubted even though their performance is on par with their male counterparts. Being meritorious is not the only thing that matters, but they have to prove themselves constantly.

One of the respondents stated that having such extra work on their own research work is exhausting. She was not assigned any work to assist her research supervisor's work. She says she doesn't get time to take on extra responsibilities. She will be busy with her work most of the time.

Another kind of extra work the research scholars get is assisting their supervisor in their research or project work, which may not be helpful for their current research but takes much of their time and energy, which negatively reflects on the scholars' research. Sometimes they are also assigned to assist their senior scholars and junior students with their projects. All this takes their time and effort and affects their research negatively.

Most of this kind of extra work is not compulsory. Depending on their current circumstances, the scholars can do or not do such additional work. From the conversation with the respondents, it was clear that, usually, nobody rejects such things, thinking about how one can say no to the supervisor. They are afraid if their no creates a negative impression and thus dissatisfaction with

us, and any problems with the supervisor. Out of that fear, one can't actually say no, even though they want to say no.

### **Professional expectations and Gender Performances**

For the success of academic life, there will be a lot of necessary and obligatory professional expectations to be met. In the case of research scholars, research paper publications, attending seminars and conferences with or without presenting research papers, and so on is mandatory. We have already seen the complexities and formalities required to meet such expectations. From the literature review, we have also found that women have to struggle a lot to meet such professional expectations. Whether in research or career, they have to work harder and continuously prove that they are meritorious on par with their male counterparts. They are being judged on the basis of their gender identity rather than their merit or hard work. Women try their level best to find a balance between their professional or academic and personal lives to meet the expectations of both. However, gender identity itself becomes a barrier to meeting professional expectations.

### **Seminars/Conferences and Publications**

Most of the respondents have attended seminars and conferences inside and outside their university. Some of them have also presented their own research papers as well. None of them have been published yet. Traveling to various places to attend seminars or conferences gives a new kind of academic experience. Still, on the other hand, it is also scary as increasing crimes are happening in the country against women and people from minority communities. As a result, being a woman from a minority community increases the risk of traveling, especially if they must travel alone.

One of the respondents said it takes extra effort and time to get their work published, apart from the tiring and busy laboratory schedule. Also, it demands a lot of additional reading. Another respondent said that the publications in science research, especially in India, are not enough based on quality; instead, people are competing to increase only the number of publications. She says it takes around one year or even more to get one paper published after submitting it as it goes through review, editing, rejections, resubmissions, and so on. But certain faculties pay the publication houses in advance to get their papers published within 3–4 months. She inquires as to

why this occurs. She said in science, people even publish about the negative results of lab experiments, but it doesn't make much sense.

### **Future Plans and Expectations**

Even though women scholars, especially Muslim women scholars, face many problems while doing scientific research, they also have hope for their future. One respondent is so deterministic and told us she wanted to spread her knowledge through her research and higher studies. She too wishes to use her knowledge to benefit poor and unprivileged children in society. She would love to teach girls and children who can't afford the economic expenses of education. She believes that she can do it after her research is over. She also loves to take her studies and research further. While discussing the future plans, one respondent said she is pessimistic because she is uncertain about finding a job or career in her home state because of several political and administrative uncertainties. But still, she expressed her hope and wished to go abroad for higher levels of research and professional development. But she also pointed out that it again depends upon the life partner she gets, and a kind of uncertainty prevails. She said she hadn't worked yet towards opportunities to go abroad as part of current research. She said it would be more comfortable for male scholars as they can travel freely and it also depends on the international faculty networks and relations of the supervisor they work with. She said that faculties, including her supervisor, who pursued higher research experience abroad, know advanced technologies in research. They only introduced various new practices and styles in research here in their department.

### **Negotiating with personal and professional life**

Aside from the pressures that women scholars face due to their academic activities, their gender roles and societal expectations of their gender roles add to the stress. Finding a balance between their personal and academic lives is an everyday problem they have to face and sort out. One of the respondents said women, especially Muslim women, doing research in science, that it is not so easy. She remembers her supervisor talking about the women research scholars joining the department and working very well in the first year or two. Then they get married, and with it come many problems in their research, and the performance level goes down. That was also why faculties were not interested in women scholars entering research under their guidance. She said



one can't just postpone getting married for so long, like until completing the research. But instead, one could choose to get married to someone from the same or relatable field of study or profession to really help us in the research and understand the difficulties and stress of research as well. She is free from the pressure of getting married from her home, but she explained some of her friends' experiences. Someone who left the course after getting married. Some married people who helped their friend go abroad and do research at a very reputable university with better laboratory facilities were also cited as examples. Even her supervisor is an excellent example of this. Thus, family support remains a significant factor in deciding women scholars' academic or professional development.

In the words of another respondent, being a female research scholar in science, which has a busy schedule of laboratory experiments, she finds it difficult to balance family and career. Even though she is not married yet, she is always concerned about her aged parents, who also have health issues. Sometimes she convinces her research supervisor to give her a break to spend time with her family, especially her parents. And sometimes, she convinces her family to give her enough time and concentration on her research. But still, she said it causes emotional struggles for her not to be with her parents as they suffer from health issues and are sometimes taken to the hospital for treatment. She also faced the societal pressure of getting married and having a family from relatives and other people many times. She thinks she needs a life partner who can support her and encourage her career goals. So, she is not worried about what people and relatives say, but she is waiting for a better person. Even though she gets married, she is confident that she will manage her research and family life and balance both. She believes that this societal demand for gender roles to be fulfilled by women is an important reason that hinders women from finding a balance between family and career. Thus, women are not entering higher studies and careers, especially in scientific research that needs time and effort. She remembers very few eminent female scholars in her research area who have made remarkable contributions to its development. She claims they are role models for female scientists and researchers.

The married respondent has a lot of trouble balancing her career and personal life. Because she encountered many occasions where she had to give preference to family, she left behind her academic activities. She said it is because society has certain stubborn rules about gender roles that some duties should only be done by women, even though men can equally do them or even

if men are ready to do them. So, in such circumstances, most of the time, these scholars can't win over the age-old practices, but they still attempt to tell the rest of the family and relatives about the stubbornness of such practices. And even if they sometimes manage to leave their gender roles behind and prefer their academic activities, it makes them emotionally disturbed. . They are socialized so that even they can't completely accept breaking or going beyond the age-old gender constraints. Some of the respondents believe that they can't take on the responsibilities of having their own family between their research courses, so they are not thinking about getting married. They will only think about it once they feel they are ready. Another fact to be noticed is that most respondents get their family's support in this matter. The family has given them the freedom to decide when to get married. As they have the support of their family, they are managing it even when they get pressure from relatives and other people to get married.

### **Everyday challenges of a practicing Muslim**

Muslims can't be taken as a homogenous group. We can see them as practicing Muslims and non-practicing Muslims for this research. We can simply define practicing Muslims as those who follow practices such as Namaz (the mandatory prayer five times a day) and the compulsory religious obligations in their daily life. Being a practicing Muslim takes conscious effort and time. It has to be the way of life and should be reflected in every walk of one's life.

For a practicing Muslim, there are a lot of compulsory obligations and practices to keep in their daily life. The respondents have explained how far they could stick to these practices while being a research scholar in science. While talking to some scholars, they are not concerned about these things. But some research scholars have shared their deep anxieties over their religious life on campus. One of the respondents, who considers herself a practicing Muslim and a highly religious person, said that she usually maintained the exact timings of her religious activities and worshiped despite the busy schedules of the research. She said that she believes God can ease her research if she prays to Him, so, prayer is equally important as hard work. But she also added that it is not easy to carry out her religious practices and her research, especially during lab time.

As a Muslim, she has to perform "Namaz," the daily prayer, five times a day. She can't leave the laboratory and go to her hostel room five times. So, she said she usually performed her "Namaz" from the lab itself. Sometimes, she feels uncomfortable because the lab is not always so clean,

especially in the rainy season, so it is difficult to perform it from an unclean place. But she is left with no other option as there is no specific place in her department building for this. She brings a prayer mat with her and somehow finds and cleans the place and uses the prayer mat for performing the "Namaz." And whenever possible, she used to go to her hostel room and perform religious activities. During her fasting days, especially during the holy month of Ramadan, in which fasting is compulsory for Muslims, she said that she usually stayed at home and carried out her research activities mostly at night. During the day, she gives more time to her religious activities, and she will be tired of fasting. So, in order to balance her research and religious activities, she discovered that this solution worked throughout the night. But that is also challenging because she will be alone in the laboratories most of the time during the night.

Another respondent said that she starts and ends her day with Namaz and significantly influences her life. She feels like she won't perform well if she misses her prayer, whether in academics or personal life. Sometimes she misses the morning namaz as she may be late and physically tired when she gets back to the hostel from laboratory work, thus oversleeping. Then it troubles her focus and concentration throughout the day. And whenever she came across any problems in her academic life, she used to pray. And she believes that can make everything alright. So, she thinks that along with hard work, we should also have a religious life in order to be successful in our personal and academic lives. So, her spiritual life is intermingled with that of her academics.

Many times, those who are living outside the campus miss their Namaz. And they depend upon their friends so that they can go to their friend's hostel rooms and perform Namaz. During Ramadan, when they are fasting, they have to get back home at the time of Iftar (fast-breaking), so they have to finish their work within that time and go back home on time. And making food and doing other homework at this time is extremely difficult.

From the conversations with the respondents, it was clear that their gender and religion did matter in the academic atmosphere. One of the respondents, named Khadeeja, said that she was not dressed as per the religious instructions in her early years on the campus and nobody even cared about it or commended her on it. Later, when she embraced religious dressing, her fellow scholars became suspicious and made communal comments. This is significant today in our country because various incidents show the clear violation of Muslim women's choices in dressing in particular.

Khadeeja also faced troubles with her research supervisor and changed her supervisor after a lot of struggle. She had to face communal comments from many people just because her new supervisor was Muslim and her earlier one was non-Muslim. These incidents prove that even in academic fields such as science, which claims to be rational and objective, discrimination exists based on gender and religion.

### **Summary**

This chapter discussed the personal experiences of the Muslim women research scholars specializing in science at the university. The chapter explained their laboratory life and the complexities of the experiments they have to carry out. The impact of the formal and informal relations and interactions with their supervisors and fellow research scholars on their personal and academic lives is also discussed. The analysis of professional expectations and gender differences has found they are interconnected. The chapter also tried to understand how they negotiate their personal lives and academic lives to balance family and societal expectations of their gender roles and professional expectations. It also discussed the everyday challenges practicing Muslims face in their academic space.

## Chapter 5

### CONCLUSION

The socio-economic and educational backwardness of the Muslim community, a religious minority in India, especially the women in the community, is a major fact that triggered this research. Along with this, the underrepresentation of women in education, in general, and in science education, in particular, also provided a moment of thought. When combined, both of these facts have given the idea of analyzing women in science from a religious perspective. Thus, the departure point of this particular research was that of the underrepresentation of women in general and Muslim women in particular in science education and research.

The research's major question is why there is an underrepresentation of women in general and Muslim women in particular. In order to address this question, the foreign and Indian experiences of women in science research and career have been analyzed. To have a deeper understanding of the question, data was collected from Muslim women research scholars specialized in science research at a central university in India through in-depth interviews. Statistical data was also collected from different sources to support the arguments put forward in this research. The goal of this study was to learn more about the sociological relevance of Muslim women in higher education and science research in particular. Muslim female scholars' motivations for pursuing science research were also studied. The research tried to explore the personal experiences of the Muslim women research scholars who specialized in science for their research. The previous literature related to the topic gave an extensive idea of women in science from a global and an Indian perspective.

### Findings

Women have been prevented from entering disciplines such as math, engineering, science, technology, and information technology because of gender prejudices about acceptable roles for women. Domestic training was prioritized over education for many women. Women's underrepresentation in science, according to studies, can be linked back to their educational status. Lack of financing and a lack of support structure in career advising and mentorship also prevented women from pursuing science education and careers as a whole. The preponderance of male scientific teachers contributed to a lack of appropriate role models for young female

aspiring scientists. Young females are discouraged by the masculine image of science. Even female teachers favor boys over girls when seeking higher education and pursuing a career in science. Women are able to enter science education and have access to it. The system, which is fundamentally designed to oppress women, will only enable entry to the lower levels of the hierarchy, with development being stifled by the glass ceiling. Female education was a major concern of the feminist movement in the late nineteenth century. As we already noted, many strands of feminism make identity politics more feasible.

According to studies, the pool of minority female scientists has to be expanded. Education and training, as well as recruiting and promotion, should all use affirmative action. Minority women's career choices are stereotyped, and this needs to change. Gendered language existed in academia, even in gender-neutral science. For example, "American Men of Science," a science magazine that features biographies and works by female scientists, does not acknowledge their existence in its title. At the bottom of the scientific hierarchy, women scientists dominate. Only a few women may be found in the higher echelons of science policy and decision-making. Science is "firmly located in the hands of a white, western, bourgeois (compulsorily heterosexual) man" in terms of both power and knowledge. According to previous research findings, women are virtually excluded from some science employment, while others are ghettoized and segregated. The biological sciences, social sciences, and humanities are all hotbeds of female scientists. They're uncommon in the disciplines of math, physics, chemistry, and engineering.

Women scientists are more common at the lower levels of technological practice, performing duties that require little scientific or technical skill and are underpaid. Scholars emphasize the need for women to hold administrative and policy-making roles due to the lack of understanding of women's educational challenges. It is not enough to have more women in science. They desire epistemological and practical changes in science. Even in Muslim countries, where new universities are being established and various educational and training programmes are being implemented to improve scientific and technological capabilities, gender discrimination, along with social-cultural barriers, check women's involvement in higher education. There are erroneous conceptions that science and technology are fields only men can excel, and curricula that fail to connect science and technology to women's daily lives.

A survey of female scientists in various fields reveals that the more influential the scientific organization, the less open it is to have women in prominent positions. While there has been significant progress for women in science, most nations still have gender gaps and a loss of women working in scientific-related employment. Women have lower enrolment in science courses, notably outside of the biological sciences, lower achievement levels, and more negative attitudes toward science discipline, particularly in Third World nations.

Differential access to resource distribution favors men over women, perpetuating a sex-based or gender-based system of inequality in research. Women with advanced degrees and qualifications are questioned about their abilities to pursue graduate studies or professional or scientific careers just because they are of a certain race. Additional barriers to entry and advancement in scientific professions for women of color include race, ethnicity, and class. Women's professional networks are more likely to be confined due to a mix of educational and research localism. Women have less opportunity to build relationships and professional ties with external institutions than men since they are less likely to train or travel outside of their surrounding area. This is a disadvantage in academics. They're stuck in the customary role of caretaker. Few people think about the collaborative role women's studies and natural science departments can play in building new curricular paradigms for the sciences in the fight to reshape science education. There is still a lot of distance between feminist educators and those who practice and teach science. In STEM fields, there is a shortage of female role models. The STEM gender gap, it is claimed, is unnatural. The cultural and learning contexts and how our society cultivates interests and abilities play a role in the gender discrepancy.

Women with STEM degrees are less likely than men to work in STEM fields, even though those who do earn 33 percent more than women in non-STEM fields. Experts believe that women who pursue STEM degrees face various challenges, some of which are subtle, such as being overlooked by lecturers, managers, or during meetings, or when it comes time for promotions. Women scientists produce much fewer papers than men, according to studies. The lack of resources, residual sex prejudice, which leads to teaching load, and the aggressive nature of science are the three key contributing factors that diminish women's productivity (in science, the works to be published could be more challenged, contradicted, and questioned uncomfortably). Approximately 80 percent of women trained in science and engineering are employed, but many

work in fields unrelated to their specialties. Women have lower earnings and higher unemployment rates than men.

Education in science and technology is extremely important in India. In order to gain admission to nationally renowned science and technology institutions, young children must undergo extensive training and preparation. It results in a great deal of sorrow and sacrifice, not only on the part of the students, but also their entire family. According to the United Nations, women make up 40 percent of STEM graduates in India, but just 14 percent of the total of 2,80,000 scientists, engineers, and technologists working in India's research development organizations. This is the case despite the fact that there are activities aimed towards women. The number of girls enrolling in science for higher education is increasing, but it is not related to the number of women joining the workforce. India is a contradiction in that it produces graduates but few researchers.

Even though men and women equally perform in science research, women are still less paid than their male fellows, preventing them from moving as far in their professions. Women are frequently persuaded that they lack the intelligence to succeed in science, and men have a natural affinity for it. Women are under-appreciated also. The post-Independence age in India has seen a fast expansion of science and technology. Jawaharlal Nehru, India's then-prime minister, supported science, technology education and research. In a capitalist culture, the prestige associated with employment in science and technology makes them exceedingly expensive and consequently elitist.

Hence, science and technology education was first available only to elite males. Women in science education and research were studied in India only after the 1970s, and comprehensive studies have been conducted only after the 1990s. In India, science and engineering have traditionally been seen as male-dominated fields. Unofficial Ph.D. training programmes frequently exclude women. The supervisor-advisee relationship is also providing less assistance to women. In critical areas like research design, proposals, publications and organizing skills, women are less likely to report receiving help from supervisors. The enrolment proportion of women at all levels in famous institutes of national importance is far lower than national percentages. Women account for almost 80 percent of university gold medals, but only 7.7 percent are present in the science and technology workforce. Women's participation in science



education does not imply a reduction in occupational gender stratification. Women in science are from families with a higher socio-economic and educational background and they are also in a higher social class than their male counterparts in science.

However, despite their more excellent socio-economic status, they continue to face gender discrimination. In order to show themselves, women scholars agreed that they must work harder than men. This is due to the underrepresentation of women in science education and careers. This also leads to increased visibility and tokenism, which is making a token or symbolic effort to be inclusive of members of minority groups, particularly by recruiting people from underrepresented groups to provide the illusion of racial or gender equality within a workforce. One of the most significant issues for female research scholars is the lack of an informal friend circle to seek assistance and support. Women lack informal social networks academic community's petty politics further alienate them. Women-to-men interaction is primarily a one-way requirement because men hardly require the assistance of their female fellows. There are subtle gendered practices in science, but science institutes' rationalism and universalism obscure gender-related issues and institutional sexism.

These practices exacerbate women's issues in science, both in the official and informal environments. Indian science lack social dynamism; this has had an impact on women. It's mystifying that experts at the country's top research organizations see nothing unreasonable in dedicating their office space to a deity or allowing caste inequities. The prestige tagged to science and engineering degrees and positions, the possibility of finding a skilled husband, and the appeal of "earning wives" have all been identified as contributing factors to the rise in the number of women in science. Gender disparities in science result from the context of the society in which science is undertaken. Women academic scientists encounter three primary challenges as a result of their gender. To begin with, there is a general male dominance at work. The feeling of loneliness comes as second. It is because of the absence of an informal circle and interactions. The third point is the contradiction between being a scientist and a woman. This gender role conundrum is about balancing gender and professional roles. Indian society only considers married women as socially acceptable. Single women are disregarded and secluded compared to married women.

As a result, unmarried, divorced or widowed, do not generally do better in the workplace. Marriage and pregnancy, on the other hand, may result in a pause in or neglect of study, resulting in a drop in scientific productivity. It comes with more responsibilities, and many domestic tasks are unavoidable. Consequently, societal and cultural impediments stand in the way of women's education and career advancement, whether they are married or single. The following are some of the most common coping mechanisms women use in science research and careers.

To begin with, women make a career compromise. Postponing research is the second option. Considerable drop is noticed in participation in conferences and the number of journal papers among women in science between 40 and 45 years. Third, a re-definition of "success" might provide satisfaction. A successful woman is able to strike a balance between her personal and professional lives. In India, it is clear that, despite their education and social status, patriarchal attitudes have an impact on women scientists' work and careers just as much as they do on women working in unorganized sectors or other professions like doctors and lawyers.

Furthermore, biological sciences employ far more women in India than physics, chemistry, or mathematics, which are the other major fields of natural science. Women's presence as permanent faculty members is determined to be slightly lower than their presence at the Ph.D. degree level. Women withdraw from their goals temporarily to fulfill the family needs. They may take short or long breaks for the same. This could manifest as fewer academic and career accomplishments in the future when compared to their male fellows.

As a result, fewer women scientists may apply for permanent positions after completing post-doctoral studies, and fewer may compete successfully with men for the same positions. Combining two factors may contribute to a higher number of women in junior levels. We may find younger, qualified women actively pursuing jobs and being hired surpassing the gender biases. Second, women in junior academic positions may not be promoted as quickly as their male counterparts. According to certain research, women frequently give the impression of underestimating their ability, which could be related to their social upbringing and environment. When it comes to attaining goals, women scientists are at a disadvantage since their personal interactions with male colleagues are hampered by patriarchal cultural obstacles of so-called morality. Long working hours are a typical characteristic in many professions that disadvantage women.

The most critical issue confronting Indian universities and other higher education institutions is a lack of resources. Women can be haunted by gaps in their professions for the rest of their careers even if they come back. Despite significant regional differences, the gender gap in science is a global issue. Married women are regarded as a "safety valve," dismissed first and hired last. The policies, which were developed primarily by men, exclude the interests of women or other marginalized groups. Some policy pronouncements are directly hazardous to women when viewed through gender justice.

When we look at the personal experiences of Muslim women doing science research in particular, we can see that they all have appropriate family support to complete their higher education. They are primarily from middle-class households. Their siblings are also well educated and serve as a source of support and guidance for them to pursue higher education. Most of their fathers have primary and sometimes secondary education, but none of their mothers are considered educated. Most mothers have only received primary education, and they marry young and remain at home for the rest of their lives. Despite the encouragement of their own families, all of the respondents encountered threats from relatives and neighbours. These individuals tried their hardest to brainwash the parents in order to prevent the family from sending their daughters for further education, especially so far away from their home state. Even though the family supported them, they were anxious about sending their girls to universities outside of their home state and kilometers away.

Furthermore, the increasing number of attacks on Muslims, which they are witnessing daily, is causing them concern. They have always believed, and continue to believe, that their daughters are not secure anywhere, even though we all witness various types of crimes against women in the country, particularly against women from minority communities. The parents were concerned about the distance, but their girls persuaded them. Even though we are studying a group of ladies from a specific religion, we constantly receive the impression that they are not homogeneous. At various stages of their higher education, the respondents have suffered exclusion and marginalization from the combination of their region and faith. It was thought that because they came from a specific location and followed a particular religion, they would be unable to complete or prosper in their studies or careers. The sufferings of Kashmiri Muslim students are

the best evidence of this. It has gotten worse due to the political developments around Article 370 and its ramifications in Kashmir.

The work pressure of the research scholars in science comes from experiments and the supervisors. Most respondents claimed that they have to give weekly reports about their research activity. And if the studies do not yield positive results, it will cause them a great deal of anxiety when it comes time to write the report at the end of the week. Supervisors were not always patient enough to provide adequate time to retry their studies and produce results. As a result, individuals must work longer hours, which has a negative impact on their health. Occasionally, their supervisor has assigned them extra work that has little to do with or contributes to their research investigations and serves merely to benefit the supervisor. Being terrified to say 'no' to the supervisor, fearing that it may upset the relationship with the supervisor, thus the research itself, the majority of the respondents agree to do the extra work offered by the supervisor. But this will further delay their research tasks and add to their work tension.

Another aspect of this particular argument is that this extra effort is a means for the scholar to develop an informal relationship with the supervisor, which may be useful in the future or even right now for the scholar's current research. However, the majority of these projects are entrusted to male research experts. Even if female scholars are on par with their male colleagues in academic achievement and research activity, they perceive that women will not execute such work efficiently. The informal rapport that the research scholar has with his supervisor can sometimes assist him in reaching out to other faculty members and even resources that are required for the research. Female students will lose out on this benefit if they are not considered for extra work and so are unable to establish a connection with their supervisor. Informal relationships with supervisors, and informal relationships with fellow researchers, play a crucial part in the lives of research scholars.

The fellow researchers can improve existing research activities through conversations, laboratory assistance and other means. Numerous societal and cultural variables limit women's friend circles, particularly Muslim women, and consequently qualify their informal interaction communities. It will leave fewer people to turn to for assistance if they require it. In an educational institution, there will be a number of academic events going on. It will undoubtedly be required to fulfill numerous organizing responsibilities in order for the event to run smoothly.

It's possible that faculty members won't handle everything on their own. As a result, it inevitably affects students, particularly those doing research academically. As a result, this is another type of added work that research academics encounter. It also occupies a lot of energy and time, which will positively and negatively impact their study work.

In a positive light, it will assist scholars in honing their organizational abilities and connecting with faculty from throughout the country or even from abroad who will be guests at the events, thus benefiting their research and plans. On the negative side, it will consume their time and energy, causing a delay in their study work and increasing stress. Science research, particularly requiring lengthy laboratory experimentation, is exceedingly costly. Though the institution offers the researchers necessary financial support, persuading the supervisor of the expenses and receiving them on time is not easy. Delays in research funding and fellowships lead studies to be delayed, interrupting the calm condition of research, whether the results or the researcher-supervisor relationship. Sometimes, it is up to the research academic faculty members to secure their studies' funding.

The majority of them believe they can no longer ask for financial assistance from their families; rather, they believe they should be financially supporting their families. Some are able to make ends meet thanks to a university fellowship. A respondent gave an example of how conflicts with the supervisor created a delay in the research fellowship, without which the study activity would not be able to advance or provide any obvious results. Both formal and informal relationships and communication are critical from a financial standpoint. In addition, research scholars used to rely on fellow researchers for financial support on occasion. Relationships with fellow scholars are therefore important from a financial standpoint. When we look at it as a whole, we can see why critical mass is vital for women in general and Muslim women in particular, as Namrata Gupta correctly points out in her studies on women in science. Experiments in the lab are an essential aspect of scientific inquiry.

Laboratory experiments and projects consumed the scholar's day and night. The academics don't even get a weekend off because they have to work in the laboratory every day. Science researchers have little or no leisure time to hang out with their friends or participate in extracurricular activities. They have experienced mental tiredness and worry due to this on numerous occasions. They may be required to arrive at the laboratory early in the morning or

remain there until late at night. Female researchers have stated that staying in the lab late at night might be frightening. Working in the laboratory left them alone at times, and returning to their hostels or homes outside of campus after work was also challenging. To cope with this laboratory environment, research scholars have experimented with various procedures and methods to make their lab hours more bearable.

They make phone calls to their friends or relatives to feel comfortable and avoid feeling lonely. Occasionally, their friends stay in the lab with them until their work is completed. Still, the second option is not always practical because admitting someone outside the lab is risky, making them even more worried and anxious. People may not always be available, particularly late at night. Even though all researchers acknowledged that getting a paper published in a science field is tough, some felt that many students and faculty members are now adding publications to their accounts in unethical ways.

According to one respondent, money and power are at work here. Paper publications are also extra work that takes time and effort to complete. Compulsory paper publications in a short period of time, which are required as part of research courses, add to the research scholars' work pressure and stress. Scholars have participated in and even helped to organize events such as seminars, conferences, and workshops. Women researchers, on the other hand, find it difficult to travel to distant locations, especially if they are alone. Their family forbids them from attending such activities due to numerous fears. Traveling within their own country is fraught with anxiety, so leaving the country is out of the question. Such events provide more opportunities to form relationships and establish connections with international or domestic colleges that are far superior in the subject areas they are conducting studies in and could be the best option for their future research. The majority of female scholars believe they have a slim chance of landing such a position.

Female researchers face an onerous burden in balancing their personal and academic lives. On the one hand, they must consider professional requirements and, on the other hand, gender role performances. Even while the parents were okay with their daughters attending universities far away from their homes for higher education, there were elderly parents who the daughters couldn't readily leave behind. Daughters experienced emotional stress as a result of the health difficulties and concerns about their ageing parents, as they felt a sense of responsibility to care

for their aged parents. Marriage is one of the most significant stressors that practically every woman encounters in her life. True, there are disparities in when and how this pressure manifests itself in their lives. The age of marriage is still a barrier to further education for Muslim women. They may face marital pressure as early as their early twenties.

When asked about this, the respondents were glad to say that they were given the freedom to decide when they wanted to marry. They also stated that they had to persuade their parents and families of the challenges they face when conducting scientific studies that are too far away from their hometown in order to persuade their parents to give their daughters such independence in their weddings. However, many of their relatives, neighbours, and village people continued to pressurize and dissuade their families from deferring marriages in order to pursue higher education.

According to respondents, people even inform their parents that their daughters sent away for studies have love affairs, and the chance of elopement is significant. However, these daughters are still trusted by their families, which is a huge comfort for them because it allows them to conduct their studies in peace everywhere. The stereotype that Muslim women marry at a young age is still prevalent. And after they get married, they either drop out of university or their grades plummet vertically. As a result, Muslim women find it difficult to enter research programmes, particularly in science. Unmarried Muslim science research scholars expressed their desire to marry a man who could assist them in furthering their studies and careers. They are acutely aware of it and committed not to jeopardize their higher education or careers, which they have worked hard to achieve. They seek a partner who will support them in their academic and professional endeavors.

Women's researchers also argue that cultural expectations of gender roles hamper women's success in science. Science research takes a lot of time and effort, so when society expects women to take on greater responsibilities simply because they are female, there is an imbalance, tension, and stress. Science research is such a time-consuming procedure that it is difficult for women to balance home and academic life. Most of the respondents cited this as the primary reason for delaying their marriage. They are under a lot of stress because most of their research is based on tests that aren't always certain to yield excellent outcomes. As a result, they must be highly focused and attentive when conducting their research, and if the experiments do not yield

positive findings, they must redo or repeat the process. In the laboratories and elsewhere, these take a lot of time and effort.

Certain Islamic activities are required of all practicing Muslims, whether male or female. Women scientists have emphasized the issue of a lack of adequate facilities for doing their most important religious practice, "Namaz." They can't always go to the hostel or wherever they typically offer Namaz because they are busy with their scientific experiments and other things most of the time. However, laboratory spaces aren't always suitable or hygienic for performing Namaz. It is quite difficult for them to do Namaz, which must be performed at a specified time, because there is no dedicated prayer hall facility within their individual research departments' buildings.

Fasting is another essential religious activity, which is practiced mostly during the Holy Month of Ramadan (the Arabic month) and lasts for a month from early morning (Fajr) until late evening (Magrib). Fasting is also disrupted by the exhausting activity in the laboratory and its schedules. Fasting may necessitate adequate rest time, which may not be attainable given the laboratory's tight schedule. Muslim women research scholars have also encountered situations in which they have felt strange for wearing particular types of clothing, and one of the respondents has had to deal with communal comments for picking a Muslim faculty member as her supervisor.

## **Conclusion**

This research was meant to explore women's experiences in science in general and Muslim women in particular. The study covered a lot of literature on women in science, both by Indian and foreign writers, to get a robust idea about women in science. The research found different problems women face in scientific research and careers generally. The literature review shows women getting ignored or not allowed access to science education is a universal phenomenon despite the geographical differences.

The research was framed by the feminist theoretical perspective, which helped to understand the issues faced by women in science from their own subjective experiences and the narration of their experiences by themselves. One of the major objectives of feminist epistemology is to let



women develop their own language of writing about what they are going through. Feminist academics have taken a proactive approach to address women's educational difficulties.

Because of gender stereotypes, women have been barred from entering math, engineering, science, technology, and computer technology. For many women, domestic training takes precedence over education. Women were also discouraged from pursuing science education and jobs due to a lack of funding and support structures in career advice and mentorship. As a response to the lack of knowledge of women's educational issues, scholars stress the necessity for women to take administrative and policy-making positions. Women scientists are more numerous at the lower levels of technological practice, where they undertake tasks that require little scientific or technical skill and pay less. There are false beliefs that science and technology are better suited to boys and curricula that do not connect them to women's daily lives. Women who pursue STEM degrees, according to experts, encounter a number of hurdles, some of which are subtle. According to studies, women scientists publish far fewer articles than men. Approximately 80 percent of women with scientific and engineering degrees are employed, but many are in fields unrelated to their subjects of study. Women earn less money and have a greater jobless rate than men.

Science and engineering have long been considered male-dominated fields in India. Women account for about 80 percent of gold medalists at Indian universities, although they account for only 7.7 percent of the science and technology workforce. Despite their groundbreaking research and performance, women in STEM are known to get less for their research jobs than men. In science, women have a higher socioeconomic standing than men. Despite this, people continue to endure prejudice based on their gender. One of the most pressing concerns for female Ph.D. students is an informal social network. There is a dearth of social dynamism in Indian science, which has impacted women. The system in India is more favorable to married women than it is to unmarried women. As a result, unmarried women and those who have been divorced or bereaved do not do better in the workplace. On the other hand, study breaks and neglect can be caused by marriage and pregnancy. It comes with extra obligations, and more household chores must be completed. Patriarchal beliefs have an impact on women scientists' careers and work in India, regardless of their degree or social background. The presence of women as permanent faculty members is slightly lower than their presence at the Ph.D. level. After post-doctoral

studies, fewer women scientists may apply for permanent posts, and fewer may compete successfully with men for the same opportunities.

When we look at the personal experiences of Muslim women doing science research, we can see that they all have good family support to complete their higher education. Despite the encouragement of their own families, all of the respondents encountered threats from relatives and neighbours. It was thought that because they came from a specific location and followed a specific religion, they would be unable to succeed in their studies or careers.

Research scholars in science report stress and anxiety from the work pressures of supervisors. Supervisors are not always patient enough to give them adequate time to retry their studies and produce results. The research scholar's informal rapport with his supervisor can sometimes assist him in reaching out to other faculty members for assistance. It's possible that faculties won't handle everything on their own. As a result, it inevitably affects students, particularly those doing research academically. Science research, particularly requiring lengthy laboratory experimentation, is exceedingly costly. Delays in research funding and fellowships cause studies to be delayed. Critical mass is vital for women in general and Muslim women in particular. Laboratory experiments and projects consumed the scholar's day and night. They have experienced mental fatigue and worry as a result. Female researchers have stated that staying in the lab late at night might be really frightening. Scholars make phone calls to their friends or relatives to feel comfortable and to avoid feeling lonely. Occasionally, their pals stay in the lab with them until their work is completed. Compulsory paper publications in a short period of time add to the research scholars' work pressure and stress.

The women scholars experienced emotional stress due to their aging parents' health concerns. The age of marriage is still a barrier to further education for Muslim women. They may face marital pressure as early as their early twenties. The daughters were glad to say that they were given a lot of freedom in deciding when they wanted to marry. The stereotype that Muslim women marry at a young age is still prevalent. After they get married, they either drop out of school or their grades plummet. As a result, Muslim women find it difficult to gain entrance to research programs. Women's researchers argue that cultural expectations of gender roles hamper women's success in science. Muslim women research scholars have emphasized the issue of a lack of adequate facilities for doing their most important religious practice, "Namaz" Fasting is

also disrupted by the exhausting activity in the laboratory and its schedules. Muslim women research scholars have also encountered situations in which they have felt strange for wearing particular types of clothing.

Despite the many hindrances they face every day in their personal and academic lives, the women scholars are optimistic about their further research and careers in science. They believe that the reformative ideas and suggestions put forward by many scholars and the policy level changes and implications of these ideas can bring about changes in the prevailing problems women face, especially Muslim women, in science.

### **Limitations and future scope of the Research**

While conducting this study, there are certain limitations faced by the researcher. First, being an outsider to science research, it was difficult to understand the complexities of science education and research. It also limited the researcher's access to specific laboratory spaces within the field. The researcher was not allowed to access the laboratory space entirely, so it may have reflected the shortcomings in robustly understanding the field. This became worse when many restrictions came into effect to check the spread of the COVID-19 pandemic in almost all departments on the campus. The spread of the pandemic and the consequent lockdown has severely interrupted the fieldwork. It delayed the completion of the fieldwork and the course. As the method used to collect primary data was in-depth interviews, it was difficult to conduct them through any other means than face-to-face. The telephonic and social media attempts to collect primary data yielded good results.

The research can be taken forward in order to have a much better understanding of women in science. The respondent size can be increased and the research site can be shifted to more sophisticated and eminent scientific research institutions and research centers.

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# Women in Science: A Case Study of Muslim Women Research Scholars at a Central University

*by* Najla P V

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