



**UNIVERSITY OF  
KWAZULU-NATAL**  

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**INYUVESI  
YAKWAZULU-NATALI**

**GENDER REGIMES IN THE LEARNING EXPERIENCES OF FEMALE  
ENGINEERING STUDENTS: THE CASE OF A MAURITIAN HIGHER  
EDUCATION INSTITUTION**

**By**

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**This thesis is submitted in fulfilment of the requirements for the  
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**August 2020**

## **Authorisation of supervisors for the submission of this thesis**

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## **Declaration**

I, Noshmee Devi Baguant declare that

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## **Abstract**

This study explores the influences of gender regimes in the learning experiences of female engineering students at a higher education institution in Mauritius. The feminist paradigm informs the problematisation and the choice of a case study as research methodology.

Data was produced through reviewing of documents, qualitative questionnaires, focus group discussions and critical individual conversations to produce deep textured insights into the challenges faced by participants. The sample for the qualitative questionnaires comprised 12 female students from Year 1, Year 2 and Year 4 of the engineering major and from these 12 participants, a sample selection of 9 participants was chosen for the focus group discussions. The qualitative questionnaires and the focus group discussions were used to sample out 6 participants for the critical individual conversations. The data was thematically analysed through an inductive approach.

The findings reveal the workings of gender regimes through how power is negotiated, claimed and legitimised by male and female students alike. The role of academic teaching staff in perpetuating certain discourses, practices and perspectives are equally highlighted.

The ‘operations of gender regimes in higher education institution’, which is an exploration of Connell’s theory of gender relations (2002), is presented and analysed. The findings draw attention to the density of gender regimes in a higher educational context through the concept of ‘intersectionality’ that is, powerlessness of individuals towards discrimination and oppression. The complexity of gender regimes in higher education is unpacked and power emerges as a salient feature of gender regimes. Four dimensions of gender relations namely gender division of labour, gender relations of power, emotion and human relations and gender culture and symbolism are inter-connected. Gender relations of power are explored, and it is found that they comprise epistemic power, cultural power, psychological power and social power. Although intersectionality does not constitute the original theoretical lens of this study, the findings draw attention to how class, ethnicity and culture coalesce in both collective and individual experiences of being a female engineering student.

The thesis concludes by elaborating on the theoretical contributions of the study and the implications of the findings on theory and on policy while pointing to the limitations of the study and proposing possibilities for future research.

## **Dedication**

*To all women*

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## **List of abbreviations**

ICT	Information and Communication Technologies
NGPF	National Gender Policy Framework
NYCBE	Nine-Year Continuous Basic Education
OECD	Organisation for Economic Cooperation and Development
PISA	Programme for International Student Assessment
SDG	Sustainable Development Goals
SET	Science, Engineering and Technology
STEM	Science, Technology, Engineering and Mathematics
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USA	United States of America

# **CHAPTER 1: CONTEXTUALISING THE STUDY: EDUCATION, STEM AND GENDER IN MAURITIUS**

## **1.1 Introduction**

The field of Science, Technology, Engineering and Mathematics (STEM) needs to address the participation of women. According to the United Nations Educational, Scientific and Cultural Organisation (UNESCO), even though there is no major difference in the number of female and male students who are completing secondary education and in the number of women who are completing higher education, women still lag behind men in STEM (2018, p. 15). The ways in which educational institutions function have a crucial responsibility in creating the interest of female students in STEM subjects and in ensuring female students an equal chance to enter and take advantage of a quality education in STEM. The teaching and learning conditions and the ways in which socialisation takes place in educational institutions are central in determining the interest of female students in and commitment to STEM. This applies particularly to engineering and to the prospects of a career in engineering. The under-representation of women in engineering has serious consequences for the economic, social and political development of any developing country (Huyer & Westholm, 2007, p. 8). This is the case in Mauritius, as women are not visible in STEM fields such as engineering (of the total students in public higher education institutions, 5.9% of men and 1.2% of women study engineering fields) (Higher Education Commission, 2020, p. 13).

## **1.2 Structure of the chapter**

In this chapter, the national context and the significance of the thesis are elaborated. Section 1 of the chapter provides a brief of the education system in Mauritius from pre-primary to higher education, including the presence of women in STEM in Mauritius and the relevance of the field of engineering to Mauritius. The context where the study takes place is presented before the research problem, to provide the reader with understandings about Mauritius as a small island developing state, its education system and the position of women in STEM.

Section 2 of this chapter explains the rationale of the research. It also includes the

need for the study, the feminist and methodological approaches, the objectives of the study and the research questions. In Section 3, the research context is described briefly. Section 4 describes the significance of the study. The last section (Section 5) of this chapter concerns the organisation of the chapters constituting the thesis.

### **1.3 Section 1: The national scene**

Mauritius is an island that is located in the southwest of the Indian Ocean. It has a total land area of 2040 km<sup>2</sup> and is part of the Mascarene Islands, with Réunion Island to the southwest and Rodrigues to the northeast. With a growing population of around 1.3 million, the population of Mauritius consists of a multicultural society of people from India, Africa, Europe and China. Mauritius has an Exclusive Economic Zone of 2.3 million km<sup>2</sup> and a continental shelf of 396,000 km<sup>2</sup> co-managed by the Republic of Seychelles. With this huge Exclusive Economic Zone, the ocean sector in Mauritius is being developed as a major pillar for economic development. Engineering plays a crucial part in the advancement in the progress of Mauritius at a time when the country is undergoing major infrastructural developments. The contribution of the engineering field is vital for such developments and setting up of the appropriate infrastructure to sustain the economic progress of the island. The road network and building infrastructure, water and power distribution systems are all examples of some of the contributions made by the engineering field to the country. In line with the extent of the infrastructural developments, the blue economy concept and the socio-economic transformations that are happening in Mauritius, there are not enough youngsters who are engaging themselves in STEM in higher education so that Mauritius can meet the future challenges.

#### **1.3.1 Education in Mauritius**

Education is globally one of the most important topics under major consideration. The case is not different for Mauritius as education is high on the agenda of the Government of Mauritius and its vision is to produce the innovative leaders who would be able to contribute to the transformation of the Republic of Mauritius into a prominent and wealthy state (Ministry of Education and Human Resources, Tertiary Education and Scientific Research, 2018, p. 5). The future of Mauritius is associated with providing its people with opportunities to acquire knowledge. Acquisition of

knowledge results in applying new knowledge and having a competent and efficient human resource with a diversity of educational opportunities, knowledge and dedication.

As Mauritius has been extensively influenced by British colonisation, the education system in Mauritius is also influenced by the British system and is thus established on such a system. After the independence of Mauritius in 1968, the Government of Mauritius has put much emphasis on access to education and quality of education to improve the country's literacy.

The education system in Mauritius consists of pre-primary education, primary education, secondary education, technical education and higher education and is regulated by the Ministry of Education, Tertiary Education, Science and Technology. The pre-primary, primary and secondary education of Mauritius has followed the English model of 3+6+5+2 until in January 2017, when the Nine-Year Continuous Basic Education (NYCBE) was implemented. The NYCBE is organised into three years of pre-primary schooling (from 3 to 5 years old), six years of primary schooling (from above 5 to 11 years old), three years of lower secondary schooling (from 12 to 14 years), two years of upper secondary schooling that lead to the Cambridge School Certificate examinations (from 15 to 16 years old), and two years of additional upper secondary schooling that lead to the Cambridge Higher School Certificate examinations (from 17 to 18 years old) (Ministry of Education and Human Resources, Tertiary Education and Scientific Research, 2016). Subject to the mode in which the programme is being offered, full-time undergraduate bachelor's degree programmes vary from three to six years, depending on the nature of the programme. The pre-primary, primary, secondary and higher education of the Mauritian education system is elaborated in the sub-sections.

Noteworthy development has been made to the education system in Mauritius, as compulsory primary and secondary education is free, transport is free for secondary school and full-time university students and there is a wide range of higher education programmes in the four public universities. In 2019, the Government of Mauritius introduced free higher education for full-time and part-time students enrolled on

programmes leading to the award of a first certificate, a first diploma and a first degree in public higher education institutions.

#### **1.3.1.1 Pre-primary education**

Pre-primary education in Mauritius is the stage of the education system, which needs to be done prior to embarking on primary education. The pre-primary education programme of study is a three-year duration programme for pupils aged from 3 to 5 years. To enable these young learners to familiarise themselves with latest technological tools, the Government of Mauritius is integrating Information and Communication Technologies (ICT) in the teaching and learning processes of pre-primary education. Furthermore, pupils with special needs and pupils belonging to economically underprivileged socio-economic environments are being addressed with special support in the Education and Human Resources Strategy Plan 2008-2020 (Ministry of Education, Culture and Human Resources, 2009). In 2018, a total enrolment of 26,183 was recorded in pre-primary schools, amongst which 12,915 were female students (Statistics Mauritius, 2020, p. 139). According to Statistics Mauritius (2020), in 2019 there was no major difference in the number of male and female students who attended pre-primary and primary schools as the Gender Parity Index indicated no disparity between male and female students.

#### **1.3.1.2 Primary education**

Primary education is the start of official and regulated education, which happens during the early years of a child and is targeted at educating learners how to learn. Primary education in Mauritius is compulsory for all children aged from 5 to 11. The duration of primary education is six years, from Grade 1 to Grade 6. Children aged from 5 to 11 years old (from Grade 1 to Grade 6) have access to digital educational resources as being appropriate to their syllabi at school. The main objectives of primary schooling are to enable students to attain essential reading ability and mathematical skills, and to enable students to achieve fundamental knowledge in science, geography, history, information technology and moral values. Conventionally, children are introduced to various core subjects such as English, French, mathematics, science, history, geography and an Asian language. Students are also introduced to subjects that are not assessed such as health and physical education, ICT and moral values. All Grade 6 students take a national examination,

the Primary School Achievement Certificate national examination, with one paper per subject, before entering secondary education that is Grade 7 (Ministry of Education and Human Resources, Tertiary Education and Scientific Research, 2016).

Studying science is obligatory in primary education. At lower primary education (Grades 1-3), science forms part of English and French; at upper primary education (Grades 4-5), science is a subject on its own. At Grade 6, science is assessed, and its learning outcome is to provide pupils with knowledge and understanding of their physical, chemical and biological environments. According to Statistics Mauritius (2020, p. 11), the gross enrolment rate in primary education in the Republic of Mauritius (Mauritius and Rodrigues) stood at 95% and 96% for male and female respectively in 2019. In 2019, for the final primary education assessment (Primary School Achievement Certificate), female students achieved higher grades compared to male students (82.8% for female students versus 71.7% for male students) (Statistics Mauritius, 2020, p. 11).

### **1.3.1.3 Secondary education**

To prepare learners and teachers for 21<sup>st</sup> Century skills, the Government of Mauritius aims to improve the learning of students by offering them with education that is not restricted by physical boundaries, through the adoption of technology in the teaching and learning processes. After succeeding the Grade 6 Primary School Achievement Certificate examinations, the students enter lower secondary schooling during their early years of adolescence (from 12 to 14 years old). There are more secondary schools in Mauritius, which provide single-sex education than co-education. Secondary education starts from Grade 7 to Grade 13. The first part of secondary education, referred to as lower secondary, is from Grade 7 to Grade 9 whereas the second part of secondary education referred to as upper secondary, covers Grades 10 to 13. In Mauritius, education is mandatory till the age of 16 and is free. The gender composition of secondary schools is categorised as mixed (including both female and male students), male (comprising male students only) and female (comprising female students only).

Although a comprehensive reform of the education system has taken place from Grades 1 to 9, the model has not changed for Grades 10 to 13 (Ministry of Education

and Human Resources, Tertiary Education and Scientific Research, 2016). Science is obligatory up to age 14 (Grade 9). In Grade 10, students are required to select six main subjects including English, French and mathematics for Cambridge School Certificate examinations. As from Grade 10, science is an optional field. The syllabi, examinations, and markings of examination papers of Cambridge School Certificate (Grade 11) and Cambridge Higher School Certificate (Grade 13) are conducted by the University of Cambridge International Examinations. However, the examinations are supervised by the Mauritius Examinations Syndicate. Regardless of several proposals provided by the Government of Mauritius, the science field is still insufficiently being chosen by female students at Cambridge School Certificate level as only 33.3% of female students studied physics at Cambridge School Certificate level in 2019 (Mauritius Examinations Syndicate, 2019). Female students enter the engineering fields in higher education institutions with equal confidence and ambition as their male counterparts, but very less women are able to stand firm in the field and eventually to have a career in engineering (National Science Board, 2016). There appears to be an invisible barrier to accelerating women's uptake of STEM. Although this barrier is acknowledged in unofficial discourse, this acknowledgement does not seem to influence the formal policies and regulations made by institutions.

In Mauritius, to be qualified to opt for a major in engineering in higher education, students should opt for science subjects in Cambridge School Certificate examinations and Cambridge Higher School Certificate examinations. Since the early 1980s, integrated science, which included all three science subjects, biology, chemistry and physics, was taught to all Grade 7, Grade 8 and Grade 9 students. Nowadays, integrated science has been renamed science. As from Grade 10 and above (that is for the Cambridge School Certificate examinations and Cambridge Higher School Certificate examinations), science is optional and consists of biology, chemistry and physics as separate subjects. Earlier, before 1980, not all the secondary schools had the required wherewithal to teach science. Today, all the secondary schools in Mauritius have the necessary infrastructural facilities to teach science. Science, taught from Grade 7 to Grade 9, enables the students to familiarise themselves with the subject, to master the subject and to make them develop their practical skills in laboratories. Moreover, this helps the students to develop their liking to science and to choose science for Grade 10 and for upper Grades. Students

are therefore given the opportunity to specialise in the three science subjects for the Cambridge School Certificate examinations and Cambridge Higher School Certificate examinations.

The number of students taking part in the 2019 Cambridge School Certificate examinations stood at 15,483, of whom 55.8% were female (Mauritius Examinations Syndicate, 2019). The overall pass rate was 71% in 2019 (Mauritius Examinations Syndicate, 2019), slightly lower than the 2018 figure of 72% (Mauritius Examinations Syndicate, 2018). According to the Mauritius Examinations Syndicate (2019), in 2019, only 33% of the total students who studied physics for the Cambridge School Certificate examinations were female students. The number of students sitting for the 2019 Cambridge Higher School Certificate examinations stood at 8,975, of whom 59.3% were female (Mauritius Examinations Syndicate, 2019). While these figures look promising in secondary education, they do find resonance in higher education, again reinforcing the idea that school-going female students/women do not pursue interest in a scientific career. The choice of a career could be conditioned less by the opportunities available and more by those cultural factors that may tacitly convey the message that some careers are not “naturally” designed for women. While there is international literature on career choice (Dunlap & Barth, 2019, p. 10; Mishkin, Wangrowicz, Dori & Dori, 2016, p. 227; van Tuijl & van der Molen, 2016, p. 176), there is comparatively scanty local based research on women in STEM fields.

The minimal presence of women in STEM in higher education was addressed by the NYCBE system, which was done with a view to better prepare prospective graduates. The NYCBE provides all students with the possibility to complete nine years of basic schooling by giving them the opportunity for various pathways as they progress as stated by the Ministry of Education and Human Resources, Tertiary Education and Scientific Research (Ministry of Education and Human Resources, Tertiary Education and Scientific Research, 2016, p. 4). The final assessments of secondary examinations, namely the Cambridge School Certificate and Cambridge Higher School Certificate, determine the ultimate input into higher education. Sometimes the entry requirements set by universities to a programme pose a barrier to joining the field (Ministry of Education and Human Resources, Tertiary Education

and Scientific Research, 2015). Curriculum reforms have taken a very general and gender insensitive perspective on equity of access in STEM fields, as no concrete mention has been made on this aspect in neither the most recent reform document of the NYCBE (Ministry of Education and Human Resources, Tertiary Education and Scientific Research, 2016), nor in the preceding one.

It is unreasonable to acknowledge a rise of women enrolment in the STEM field in higher education when statistics demonstrate that hardly any female student secondary education is ready to study physics in upper secondary classes. Many may find the curriculum uninspiring due to the amount and complexity of material. Moreover, they are only taught what they need to know to succeed in the examinations.

#### **1.3.1.4 Higher education**

Higher education represents a key focus of the Government of Mauritius. Considering the requirement to build a developed nation, with structures similar to developed countries, the Government of Mauritius has laid emphasis on the importance of higher education. The previous Government proposed to have one graduate per family to increase retention in and access to universities in Mauritius and thus increase the number of students joining higher education, with a vision of a highly qualified workforce. As stated by the then Ministry of Tertiary Education, Science, Research and Technology in 2013, the ambition of Mauritius is to transform the Mauritian society into a knowledge-based economy (Ministry of Tertiary Education, Science, Research and Technology, 2013). In the view of becoming a knowledge society, Mauritius is investing a lot in the education sector, to include technology in the teaching and learning processes and by implementing the educational reform.

As indicated above, equity issues often centre on a class-based approach rather than being affirmative in terms of a gender-based approach. It does appear that resolving some measures of the imbalance in gendered access to STEM, and particularly to engineering, is not constructed as a priority.

Higher education in Mauritius, which comprises public and private higher education institutions, offers various fields and levels of study and all the higher education institutions offer co-education. The publicly funded higher education institutions include the University of Mauritius, the University of Technology, Mauritius, the Open University of Mauritius, the Université des Mascareignes, the Mahatma Gandhi Institute and the Rabindranath Tagore Institute, the Mauritius Institute of Training and Development, the Mauritius Institute of Health, the Mauritius Institute of Education, the Fashion and Design Institute and the Polytechnics Mauritius Ltd. The higher education system is also supported by private higher education institutions, in total, 43 (Higher Education Commission, 2020, p. 12), which offer a broad spectrum of programmes in a variety of disciplines such as Management, Accountancy, Medicine, Pharmacy, Engineering and Information Technology. Many of the private higher education institutions offer programmes awarded by international universities through franchise. In 2018, from the total number of students enrolled in the engineering field, no major change in women enrolment was reported in the public (24%) (Tertiary Education Commission, 2018, p. 19) and in the private (23%) (Tertiary Education Commission, 2018, p. 72) higher education institutions in Mauritius. This shows that the low enrolment of women in the engineering field is evident also in both public and private higher education institutions. Although all public higher education institutions in Mauritius offer free higher education to those students who are enrolling for the first time on certificate, diploma or an undergraduate degree, this does not have an impact on the female enrolment in STEM.

According to the report of Statistics Mauritius (2020, p. 11), in 2019 more female students were enrolled in secondary education than male students. This disparity is also suggested by UNESCO as a global phenomenon (UNESCO, 2018, p. 11). In Mauritius, in secondary education, female students have been performing better than their male counterparts at the Cambridge Higher School Certificate examinations – 59.3% of students who took part in the Cambridge Higher School Certificate examinations in 2019 were women (Mauritius Examinations Syndicate, 2020). Consequently, more female students than male students were enrolled in higher education institutions. The enrolment of female and male students in higher education rose with an expanding gap in favour of female students. Enrolment in

higher education of female students, as shown by the figures increased from 58.2% in 2018 to 58.5% in 2019 (Higher Education Commission, 2020, p. 6). Although there is a predominance of female enrolment in higher education in Mauritius (as per the figures revealed by the Higher Education Commission, 2020), a gender disparity exists in the fields of study in higher education. According to García-Holgado, Mena, García-Peñalvo, Pascual, Heikkinen, Harmoinen, García-Ramos, Peñabaena-Niebles and Amores (2020), enrolment in higher education in STEM fields generally indicates further evidence of a gender gap. In Mauritius, the situation is similar as in 2019, female students were under-represented in STEM fields in higher education; for example the representation of female students in engineering was only 2% in 2019 in higher education (Statistics Mauritius, 2020, p. 13). This representation is aligned to traditional ideas on social roles that often lead to gender biases in occupations, where women are often employed in caregiving sectors of employment (Ellemers, 2018, p. 275). This also concurs with Jarman, Blackburn and Racko (2012), who state that employment in policing is dominated by men and nursing is associated with women. The above statistics suggest that fewer women, compared to men opt for engineering and information technology in higher education. In Mauritius, although there is a predominance of female enrolment in higher education, a gender inequity exists in the different fields of study in higher education, particularly in the engineering fields. For instance, only 2% of students who are enrolled in different engineering courses such as mechanical, mechatronics, civil, electrical, and electronic engineering are women (Statistics Mauritius, 2020, p. 13). As stated by Butler, gender is socially and culturally constructed and it is not directly associated with sex (2011, pp. 9-10). Therefore, to enable the growth of Mauritius towards a knowledge society, the relationship between STEM and gender should be a priority to achieve gender equity. Hooks argued that “the very start of the women’s liberation movement visionary thinkers” would fight to grant women civil rights within what she referred to as “white supremacist capitalist patriarchal system” (Hooks, 2000, p. 118). Hooks argued that an educational institution is not the site where students should be inculcated to support ‘imperialist white-supremacist capitalist patriarchy’ but is rather a place where they should open their minds and think critically (2013). It is crucial to understand that gender roles are socially and culturally created and that having a deliberate intent to keep women in subordinated positions in order to advance patriarchy would keep women in

servitude to men and to a capitalist patriarchal society. Increasing the participation of women in STEM would help to diminish the gender difference in salary, improve women's economic security and prevent biases in these fields.

In Mauritius, gender equity is guaranteed through law. According to Section 17 of the Equal Opportunities Act 2012 (Revised Laws of Mauritius, 2012, p. 13), both male and female have equal access to education, except in cases where a higher education institution may reject a student's application due to its specificity in its student population (single-sex). The statement that women face no obstacles when entering STEM in higher education seems not to be true in reality as women in Mauritius are highly under-represented in STEM, although the education system provides all students with the same opportunities to study STEM from primary education to university. However, the small presence of female students in the engineering fields is still of concern. Mbano and Nolan (2017, p. 55) argued that the impediments of women in STEM, such as pedagogy, classroom climate, gendered dynamics and communities of learning, inhibit women from participating fully in STEM fields. The under-representation of women in higher education is more persuasively described as an institutional culture that offers women limited prospects, little encouragement, and discrimination in management roles (Xu, 2008, p. 607). Such structural impediments prevent women from accessing STEM and are, therefore, the enablers for women's subordination. A key aspect of the subordination of women stems from patriarchal society as being the "natural order of things" and from cultural beliefs that attribute gender role of women to inferiority (Mathur, 2019, p. 165). It is crucial to recognise how educational institutions can increase the participation of women in STEM fields and to understand the gendered cultural practices that enhance female subjugation in STEM fields.

### **1.3.2 Participation of women in STEM**

Women are under-represented both in STEM majors and in STEM jobs over the last ten years. Part of this under-representation is due to the ways in which institutions generally reflect societal cultural practices. According to Dunn (1998, p. 9), individuals construct their identity inside a comprehensive arena of socially constructed meanings and roles, and inside an institutional setting. Dunn (1998, p. 11) further argues that modern society can be considered as disaggregated "through

the differentiation of social roles and social functions”. Social functions and roles have prevented the comparatively few female students who graduate from STEM majors from concentrating on engineering. Thus, women who graduate in STEM majors rarely undertake a STEM job. STEM jobs include those in physical, biological, medical, health, and computer sciences; engineering; and mathematics (Wang & Degol, 2013).

Internationally, gender and higher education have received increasing attention (Vijayakumar, 2012, p. 1). Gendered socialisation, including societal, cultural and gender patterns, has an influence on the way young men and young women grow and interact with the community. Such influences develop the gendered beliefs and gendered roles of women and men. Young women are often made to believe that STEM fields are associated with men and that women’s innate abilities are in contradiction with STEM (UNESCO, 2017, p. 12). Although research on biological factors challenges such beliefs, these beliefs continue to reduce the confidence and interests of women in STEM fields (Trauth, 2006, p. 1154). To prepare students for new challenges of this globalised world in the fields of STEM, science education is of utmost importance (Rose, 2005; Schleicher, Zimmer, Evans, & Clements, 2009). Gender regime is described as the arrangement of practices that produces different types of masculinity and of femininity between staff and students by assigning gender roles to them based on their sexual belonging, which creates a division of labour (Kessler, Ashenden, Connell & Dowsett, 1985, p. 42). Arrangements in institutions, together with the engraved gender relations form the gender regime, which control the society (Dunne, Leach, Chilisa, Maundeni, Tabulawa, Kutor, Forde & Asamoah, 2005, p. 4). Therefore, sociological factors, cultural factors and curriculum biases associated with gender regimes within an educational institution have an influence on women in STEM.

The rapid economic growth and gender-neutral educational and employment opportunities in Singapore, which is a context similar to that of Mauritius, have significantly enhanced the employment of women, thus increasing gender equality in the labour force (Lim, 2011, p. 13). However, in Mauritius, despite policy initiatives such as the National Gender Policy Framework, there appears to be a glass ceiling. For the minority of female students who opt to study STEM subjects in higher

education, there are several intertwined details of the existence of gender gap in STEM. There are institutional barriers that “have historically kept women from entering and then flourishing in STEM, such as equal pay for equal work, maternity leave, and the covert, often overt patriarchal, misogynistic culture that permits men to objectify women’s bodies and minds are verboten” (Chesky & Goldstein, 2018, pp. 108-109). According to Yatskiv (2017, p. 87), women have faced challenges in higher education when they entered STEM fields, as they felt the presence of the patriarchal culture. According to the UNESCO (2017, p. 15), when “fewer women than men choose STEM” field in education, this causes gender inequity. Internationally, the presence of female students in STEM fields is progressing very slowly but the gap continues to be surprisingly resistant nonetheless (Modi, Schoenberg & Salmond, 2012). Social, financial and cultural beliefs about gender prevent women from exploiting their competence in their field of preference (Herz, Herz & Sperling, 2004). Feminism has guided the approach of exploring the dominance of men and patriarchal dividend (Dunn, 1998, p. 5). Feminists located the regime(s) present in institutions as being the reasons for why women do not come into STEM or why they do not succeed in STEM. I therefore want to study the gender regimes present in a higher education institution in Mauritius.

### **1.3.3 Relevance of the field of engineering in the Mauritian context**

The engineering field is a vehicle that can shape the growth of Mauritius and its ambition to shift from a developing to a developed country. Since 1968, different governmental authorities in Mauritius have been actively participating in education with a view to making its human resource competent and efficient. Although developing countries require engineers for its infrastructural and technological development, there are still few female engineers (Meiksins, Layne, Beddoes, Martini, McCusker, Rideau & Shah, 2016, p. 341). The case is similar in Mauritius, as few women are opting for engineering in higher education.

Despite the considerable progress that Mauritius has made in terms of access of female students to higher education, equity of treatment and inclusion, the engineering field has a long way to go. This is the reason why the study is of contextual relevance. Amongst the Southern African Development Community countries, together with Madagascar, Malawi, South Africa and Zimbabwe,

Mauritius has more than 30% women enrolment in higher education (Southern African Development Community, 2016, p. 38). Women in Mauritius are in a better position to graduate in management and the humanities than in STEM fields (Gokulsing & Tandrayen-Ragoobur, 2014, p. 630). Although Mauritius tops the rankings in higher education, it seems that the country is unable to increase female students' uptake in science in secondary education and in the selection into engineering in higher education. The existing literature regarding this issue points towards strong and persistent systemic, structural and cultural features in educational institutions that enable certain practices to persist. These practices covertly influence the nature of women's experiences with STEM and their self-concept and efficacy, and overall influence their pre-dispositioning to persist in a STEM career. Within educational institutions, micro-aggressions and covertly sexist acts set and offer crucial borders to the gender regime within which individuals develop their identity and roles (Dunne et al. 2005, p. 4). At a deeper level, the academic curriculum is associated with the gender relations of power such as the curriculum, which is already prescribed by the management of the university and generally reproduces the gendered practices of men (Kessler, Ashenden, Connell & Dowsett, 1985, p. 43). According to some female academics, a role model employee is not someone who is associated with caregiving (Reilly, Jones, Rey Vasquez & Krisjanous, 2016, p. 1029). The robust male or female identification of specific curriculum topics powerfully associates students with gendered identities (Dunne et al., 2005, p. 42). This leads to gender inequity and reinforces gender regimes within educational institutions.

It appears that two areas in which there is under-representation of women in Mauritius are politics and engineering. This suggests that there are gendered practices that appear to be embedded in political and educational structures. These have not yet been uncovered and work has to be completed to foreground this decisively as an area requiring academic attention.

## **1.4 Section 2: Purpose of the study**

The current study explores how gender regimes that exist in a higher education institution influence the learning experiences of female engineering students at a higher education institution in Mauritius.

### **1.4.1 Rationale of the study**

In Mauritius, although gender access to education is not a major concern, there is a persistent gender bias in higher education enrolment in engineering fields; gender equity should be improved. I chose to foreground women only in this study, instead of researching other genders, because the presence of women in science subjects and in engineering in secondary education has not been increasing over the previous years. For instance, in 2019 only 43% of the female students of the total enrolment in biology, chemistry and physics, sat for Cambridge School Certificate examinations (Mauritius Examinations Syndicate, 2019). In higher education, the situation is similar. The enrolment of women in 2018/2019 in STEM, particularly in engineering in higher education, was low compared to that of men as female enrolment in engineering undergraduate degrees stood at 31% compared to male enrolment (Statistics Mauritius, 2020, p. 152). The participation of women keeps decreasing in STEM subjects as they move upwards; for example, from the 33.3% of female students who studied physics at Cambridge School Certificate in 2019 (Mauritius Examinations Syndicate, 2019), only 1.2% of female students joined engineering in public higher education institution (Higher Education Commission, 2020, p. 13). It was found that women engineers experience the workplace as gendered – the experiences of bias and sexism are common in the workplace (Smith & Gayles, 2018, p. 11). Although gender and access to education on paper is not an issue, the above figures clearly reveal the contrary. In secondary and higher education, gendered experiences are at play within curriculum, educational practices, assessment and relationship with peers and teachers (Bunwaree, 1999, p. 150). Gendered experiences are likely to influence the enrolment of women in STEM.

In higher education, fewer female students are enrolled in STEM related fields compared to male students (Marginson, Tytler, Freeman & Roberts, 2013, p. 60) globally and the case is not different for Mauritius, as was revealed earlier by the

figures. According to Smith (2011), gender stereotypes about beliefs and attitudes often influence the learning experiences of women in STEM or their choice of STEM, thus preventing them from engaging in STEM subjects in higher education. The learning experiences of women in STEM are negotiated when academic teaching staff embrace gendered beliefs about STEM that make them behave differently in the classroom with men and women (Carrington, Tymms & Merrell, 2008). Curriculum, including content, pedagogy, assessment and field-based work, relationship between academic teaching staff and female students, the relationship between men and women and perceptions and beliefs create gender relations (Connell, 1987, p. 120) between students and academic teaching staff, in what is called the gender regimes in an institution.

Gender regimes refer to a dynamic pattern of “gender relations in a given institution” (Connell, 1987, p. 120). According to Connell (2006, p. 839), gender relations are not simply a “shapeless heap of data but are found in all spheres of life, including organisations” and Connell also argues that the complete arrangement of gender relations in an organisation is called a gender regime. Gender regimes in an institution may be the reason for the low participation of women in the engineering field in higher education. The disparities in terms of female enrolment in STEM between secondary education and higher education straightforwardly influence the learning experiences of women in STEM at university, as they are often torn between the hegemonic masculinity of male peers and academic teaching staff, the category of secondary school (single-sex education/co-education) that women attended and the physique of the women.

Studies worldwide have been done on gender and STEM (Gill, 2015; Blosser, 2017). There has been a large body of research that has focused on gender and choice of subjects (Henriksen, Dillon & Ryder, 2015; Musumeci, 2015; Stoet & Geary, 2018). Although gender regimes have been studied in pre-primary, primary and secondary schools and the engineering workplace (Dunne, 2007; Le Mat, 2016; Ullman, 2017), not much has been done on gender regimes within higher education institutions. The implicit assumption that higher education is not plagued by the same gender stereotypes and gendered relations are indefensible, given the enrolment and completion rates of women. A deliberate choice has been made to focus this study on

the higher education sector to put precisely such assumptions to the test. I sought to gain knowledge on how and why higher education in STEM is a gendered space, in line with an existing body of literature on primary and secondary education. Research needs to be done on the experiences of teaching and learning and the qualitative nature of this study has illuminated the phenomenon. It is known that higher education is also a gendered space like primary education, secondary education and the engineering workplace. However, not much is known on the micro processes, which exist in the gendered space in higher education. It seems that there is no study on the micro processes that contribute to or create the gendered nature of the experiences. The rationale for this study is to focus on this gap. The current study has contributed to this body of knowledge particularly because it focuses on the learning experiences of women enrolled in an engineering major. It is crucial to recognise the need for understanding gender regime as this has implications on the kind of learning experiences the women have. The core objective of the current study is to generate understanding of how the established gender regimes influence the learning experiences of female engineering students at a higher education institution in Mauritius.

In the Mauritian context, not much research has been done on gender relations and higher education, and consequently it is important to understand that this issue is not only due to the need for more female engineers in the country but also due to understanding how gender relations play themselves out in higher education institutions. Learning experiences, gender roles, beliefs and stereotypes are the factors influencing the participation of women in STEM. This study offers the possibility to examine the student-self (including the curriculum and physique), student-student and student-faculty dimensions of female students' experiences studying engineering in a Mauritian higher education institution and seeks to know how and why gender regimes influence the experiences of female engineering students at a higher education institution in Mauritius in the way they do. The alternative approach taken in this study could serve to illuminate a holistic understanding of the influences of gender regimes on the learning experiences of female engineering students.

Mauritius is a small developing island and multi-cultural state that seeks to position

itself in the international arena. The Government of Mauritius, through the then Ministry of Women's Rights, Child Development and Family Welfare (2008), has valorised the progress made to achieve gender equality and the empowerment of women through the National Gender Policy Framework in 2008, which is in line with the United Nations Post-2015, with the aim of changing attitudes and beliefs of people to achieve gender equality and accordingly a fairer and more just society. The vision of the National Gender Policy Framework in 2008 is to have a society in which men and women are treated equally. In 2009, the Gender Policy Statement was developed in line with the 2008 National Gender Policy Framework and the policy states that "Educational outcomes and achievements are also influenced by what is happening outside the educational system: in the family and the world of work. This is the case while a student is within the system and before he or she enters it. The environment can sustain stereotypes, shape expectations about girls' and boys' study choices and career choices, even before they go to school. The world of employment also affects study choices for women and men differently to the extent that there is sex-typing of occupations and industries and discrimination in the world of work" (Ministry of Education, Culture and Human Resources, 2009, p. 2). Furthermore, the National Gender Policy Framework also mentions that the differences between men and women are present in the approach that they adopt to mingle with and relate to each other, in the home, school, work and social settings. It is about perceptions, attitudes, norms, beliefs and value systems about this gender interaction, which may be held by multiple actors - parents, teachers, students and employers. It is noted that there have been reforms recently in the education system in Mauritius. How far do such reforms affect the established realities of a post-colonial patriarchal Mauritius? The study thus stands as being potentially valuable as it offers a rich scope to encompass the current understanding of gender regimes and learning experiences in a developing country.

Education is one of the most significant pillars of the Mauritian economy and equality in STEM enrolment across the different STEM programmes is crucial for the development of Mauritius. Gender equity is indispensable in the engineering field, as it would also empower women for advancing development at all levels of the economy. This study is timely because it uncovers the process of learning, including the hidden curriculum, within classrooms and other learning spaces within

a higher education institution, with a view to enabling this. “Politics shapes the progress of gender equity within the political and institutional realities” (Nazneen & Hickey, 2019, p. 21). This causes higher education institutions to perpetuate and legitimise certain gender-biased practices that are contrary to their policies. In higher education, leadership sometimes worsens inequity and encourages power relations (Lipton, 2015, p. 23). This study therefore offers the possibility of unpacking the extent to which gender equity has been pursued in a male-dominated field of study, and within a context that is still largely patriarchal. The study does this by exploring gender regimes existing in the field of engineering at a higher education institution and the learning experiences of women in that specific field.

To be able to address gender inequality in the STEM field, it is crucial to study and understand gender regimes, within the context of feminist scholarship. Gender regimes are particularly important to study because a regime is powerful in that it orders practice. Gender regime is used to refer to gendered forms of practices in an institution (McRobbie, 2004 p. 262). Feminists have developed a range of theories in connection with experiences of women and their subordination, related to inequality, beliefs and institutions (Stacey, 1993, p. 50). Several regimes may be present in one institutional context. In this study, it was argued earlier that the context of higher education in engineering is not experientially supportive of women even though it may appear to be at face value. The micro and macro processes involved in shaping women’s experiences and progression within the institutional settings have encouraged patriarchy in STEM. By locating itself in the feminist paradigm, this study offers an exploration of how and why women suffer from discrimination and inferiority in STEM.

#### **1.4.2 Need for the study**

Many international scholars have studied the presence of women in STEM education. Attempts to increase the enrolment of female students in STEM fields have been a lengthy endeavour. According to Wang and Degol (2017), a range of causes has contributed to unsuccessful enrolment efforts, including social factors (Thackeray, 2016) and institutional structures (Bottia, Stearns, Mickelson, Moller & Valentino, 2015). Adequate support must be given to students for retention in STEM (Corbett & Hill, 2015). Higher education institutions emphasise mainly on enrolment

rather than providing all the required support to students till they graduate. However, Corbett and Hill (2015, p. 92) argue that the recruitment of women in STEM would be fruitful if women continued in such fields. Retention strengths should also comprise reassuring attitudes and support of academic teaching staff (Blair, Miller, Ong & Zastavker, 2017, pp. 14-43) and a greater presence of female academic teaching staff in STEM (Vieyra, Gilmore & Timmerman, 2011). Women in STEM face cultural stereotypes (Bench, Lench, Liew, Miner & Flores, 2015; Luong & Knobloch-Westerwick, 2017) regarding physique, physical attires, and behaviour. When they appear too feminine, that is taken to indicate that they are not fit for STEM (Banchefsky, Westfall, Park & Judd, 2016) and women thus prefer to exaggerate or restrict their gender, based on the context (Goldman, 2012). How can gender regimes influence the learning experiences of female engineering students? How do female engineering students experience their learning and how can gender regimes influence their persistence in the engineering major?

The gap in the literature on learning experiences and gender regimes is of further significance for this study. The focus of this study is on the manifestations of gender regimes in a higher education institution. Although numerous studies have been done on gender and engineering, there is a dearth of research that has attempted to gain profound understanding into gender and higher education in Mauritius. This study will contribute to understanding the relationship between learning experiences of female students in engineering and gender regimes. It probes specifically into what the female engineering participants experienced in learning engineering in a higher education institution, to achieve a deeper understanding of the experiences of female engineering students in Mauritius. In particular, the study also looks at the types of gender regimes existing in a Mauritian higher education institution.

### **1.4.3 Feminist and methodological approaches**

This study adopts a feminist style in understanding the prevalent gender regimes in the Mauritian higher education context. While there exist multiple definitions and understandings of feminism, Ahl (2004, p. 16) notes that, at its core, feminism recognises the inequality that exists between men and women and the aspiration to fight against such inequality to change this. Feminism, therefore, emphasises the discriminatory power relations that make women inferior and how their social and

economic roles are defined in line with male standards (Ahl, 2004). My approach to this study is grounded in the liberal feminist approach, which involves taking a critical perspective on how the learning experiences of women in higher education are shaped by a range of forces and practices that reinforce already internalised ways of being, learning, doing and becoming, which are steeped in processes that subjugate women. The liberal feminist approach adopted for this study has helped to gain knowledge about the shifts in power that are bounded by gender regimes. In feminist theory the undoing of patriarchy, which is “the system of totality and universalism of female oppression that exists everywhere regardless of culture and historical setting” (Fuss, 1989, p 2), is central. According to Skelton, Francis and Smulyan (2006, p. 11), most feminists argue that gendered behaviour is socially constructed according to cultures and historic periods. According to de Beauvoir (1953, p. 29), a woman is always a woman first, which is an identity given to her by men and which cannot be taken away.

Gendered mindsets are incorporated in all societal bodies, where they openly affect women’s experience (Vanner, 2015, p. 3). According to Özkazanç and Sayilan (2008, p. 1), an educational institution is a “hegemonic site where gender is reconstructed within the context of a peculiar gender regime” and it is the site where the construction of femininities takes place (Özkazanç & Sayilan, 2008, p. 2). Power forms an important aspect in an educational institution. Often, masculinity is construed as power. Within the gendered practices in an educational institution, there are many women who stay out of those cultures of masculine power that use their hegemonic force to oppose the ‘taming’ school authority (Özkazanç & Sayilan, 2008, p. 4). Hegemonic masculinity, patriarchy, and power combine to comprise gender regimes in educational institutions that may influence the learning experiences of female students.

To find an answer to how gender regimes influence the learning experiences of female students, document analysis, qualitative questionnaires, focus group discussions and critical individual conversations were used to study the phenomenon. This was achieved in this study primarily by focusing on the discourses of the female engineering students about their learning experiences in a specific context of learning engineering. The qualitative methodological approach

being opted for this study in the field of engineering constitutes a relatively innovative view on the question in the local Mauritian context, where scholarship has tended to be quantitatively oriented, and often without a feminist lens. As student voices continue to be the greatest influential evidence of the gendered type of education being offered to students (Vanner, 2015, p. 14), for this study the experiences of women were captured mainly through critical individual conversations. This takes into consideration that learning experiences reflect the cultural and psychological traditions, which shape people's views and attitudes (Taylor, 2017, p. 18). Critical individual conversations enabled me to access the micro processes that create the gendered environment and to focus on the experiences of women as intrinsic. The participants in this study were given the opportunity to share their experiences through conversations. Through the lens of learning experiences, the internal and external dimensions of gender regimes were studied. The internal dimensions include the cognitive (what and how did the participants learn?), affective (how did they feel about what they learnt?) and behavioural dimensions of learning experiences of the participants (what are the actions and practices that the participants engaged in?). The external dimensions encompass the social space (peers, academic teaching staff and curriculum), which also revealed the micro processes.

#### **1.4.4 Objectives of the study**

The objectives of this study are:

- a) To generate understanding of the gender regimes that are in place in a higher education institution and how these gender regimes shape the learning experiences of female engineering students.
- b) To generate understanding as to why gender regimes, influence the learning experiences of female engineering students at a higher education institution in Mauritius in the way they do.

#### **1.4.5 Research questions**

The research questions are formulated as follows:

- a) What types of gender regimes are present in the learning experiences of female engineering students in a higher education institution located in Mauritius?

- b) In what ways do these gender regimes shape the learning experiences of female engineering students in the selected institution?
- c) Why do the gender regimes influence the learning experiences of female engineering students in the way they do?

### **1.5 Section 3: Research context**

The study takes place at a higher education institution, which is one of the ten publicly funded higher education institutions in Mauritius. For ethical reasons, I name the university 'Fly University'. Fly University was historically constructed as the most prestigious university, in 1965. It began as the School of Agriculture to assist in the economy of Mauritius, which depended on its agricultural resources. At that time, it was the only institution offering higher education in the country. Fly University aims to become a prominent global university. Fly University is one of the biggest providers of higher education in the country and accounted for 35.2% of the higher student population in 2019 (Higher Education Commission, 2020, p. 7). It comprises six faculties and is renowned for having a high standard of education. In 2020, the Higher Education Commission (2020, p. 26) revealed that the enrolment at the Faculty of Engineering was 12.2% of total higher education enrolment of which only 3.7% were female students. Fly University is the only higher education institution in Mauritius offering programmes on gender studies.

Fly University has been a pioneer in offering engineering programmes in Mauritius and thus offers a comprehensive experience to students in the field of engineering. It has a well-established Faculty of Engineering, with the necessary organisational structures in place, and is well established and recognised in the country for offering engineering programmes. Fly University is an interesting space to be the chosen site for the study, as it is historically, academically and culturally significant, and brings a unique perspective to gender regimes.

### **1.6 Section 4: Significance of the study**

It is expected that this research has the potential to uncover the gender regimes and their links to learning experiences of female students in engineering, identify limitations, challenges and areas of improvement to suggest strategies which can be used to increase the participation of women in engineering in higher education and to

improve their learning experiences. The gendered culture in society goes a long way towards establishing the gendered culture in institutions. However, what is less known is how far gender regimes are manifested in higher education institutions, particularly in engineering education? There is little research in recent years that addresses issues of gender regimes and the engineering field. The findings from this study can be used to enhance knowledge in this area of research and address the silence in the literature. It is hoped that this study will highlight the gender regimes in higher education institutions and provide the opportunity to improve the learning experiences of women in engineering majors.

## **1.7 Section 5: Organisation of the thesis**

### *Chapter 1: Contextualising the study: Education, STEM and gender in Mauritius*

The first chapter has introduced this study and offered contextual information about the study on gender and STEM that has reinforced my own inspiration for this study. The lack of literature on my topic was emphasised as the necessity for my study.

### *Chapter 2: Developing the theoretical lens of the study: Feminist perspectives and theories*

Chapter 2 offers the theoretical framework of this study. It presents a discussion on feminism as an underpinning framework, and more specifically, liberal feminism as the adopted theoretical framework. The chapter attempts to establish the significance of this framework in understanding the nature and significance of gender regimes among women students studying engineering in the context of Mauritius. Emerging insights from the literature scrutinised also serve to establish the ways in which this chosen theoretical framework has guided my choice of the research methodology for the production and analysis of the data.

### *Chapter 3: Reviewing the literature: Gender and STEM in higher education*

The chapter analyses the literature drawing on the body of scholarship around the presence of women in STEM careers, the progress of women in STEM in developing countries and the absence of women in STEM. The chapter focuses on international scholarship to address the global picture and to allow for articulations with the local scene. The intention of the chapter is to show the gap that this study sought to fill through original research, that is focusing on women who are engaged in studying

engineering in higher education institutions, particularly looking at their learning experiences.

*Chapter 4: Designing the case study: Reaching the voices of female engineering students*

Chapter 4 also engages with the literature as it explains and validates the research methodology, especially regarding the choice of qualitative research approach, feminist paradigm and case study methodology. The choice and profile of participants and instruments for data production is detailed. The research protocols and ethical considerations that were observed, are explained. Additionally, in this chapter, I dwell upon the dilemmas I faced during the data analysis phase and how I tackled and resolved these. Finally, the analytical framework is outlined with respect to the different levels of analysis.

*Chapter 5: Presenting the findings: Learning experiences of female engineering students*

The critical individual conversations of the five cases are presented in chapter 5. The findings are presented under the major themes, namely: male students as superior, single-sex education/co-education, physique and differential treatment by academic teaching staff.

*Chapter 6: Unmasking gender regimes in the learning experiences of female engineering students in higher education*

A further analysis organised using a thematic approach from the major themes, which surfaced from the findings, is presented in this chapter. A comparative approach is then adopted to further analyse the findings in relation to the themes and the multiplicity of methods adopted in the study. In this same chapter, the ‘operations of gender regimes in higher education institution’, which is an exploration of Connell’s theory of gender relations (2002), is presented and analysed.

*Chapter 7: Developing the thesis: Challenging masculinities, power and gender regimes*

Chapter 7 is the final chapter. In this chapter, the three research questions are

answered. The contributions and implications of the findings from my study on theory and on policy are brought out. The chapter nevertheless provides guidance on the limitations of the study and proposes future avenues for new studies.

### **1.8 Chapter summary**

The present study is undertaken in the specific setting of a multicultural and small island developing state, Mauritius. In the next chapter, the literature is examined with regard to feminism and gender. Emerging understandings from the literature examined also serve to establish the theoretical framework that guided my choice of the research methodology for the production and analysis of the data. This theoretical framework is also presented in the next chapter.

## **CHAPTER 2: DEVELOPING THE THEORETICAL LENS OF THE STUDY: FEMINIST PERSPECTIVES AND THEORIES**

### **2.1 Introduction**

This chapter maps out the theoretical orientation of feminism and problematises it through a literature review from a theoretical stance. The relevant literature enabled an understanding of the nature of the phenomenon under study and provided a theoretical lens to design the data generation plan, produce tools for data generation and analyse the data.

### **2.2 Structure of the chapter**

Section 1 of this chapter presents the different waves of feminism and different feminist theories and it particularly elaborates on liberal feminism and gender socialisation theory. Part of the deliberate thinking in this study was the need to select a theoretical framework that would guide the choice of research methodology to produce and to analyse data.

While many theorists have contributed in shaping the multi-layered concept of gender regimes and many of the ideas are interconnected, I have chosen Connell's theory of gender relations (2002) for particular reasons, as described in Section 2, to further analyse and unpack the gender regimes present in the selected educational institution.

### **2.3 Section 1: Feminism and feminist theories**

#### **2.3.1 Feminism**

As already alluded to above, there exists no singular definition of feminism. Feminism was being used in English language in the 1880s, representing encouragement to offer women equal legal and political rights as men (Bryson, 2016, p. 1). According to Ahl (2004, p. 16), feminism is the ability to recognise that men and women are in unequal settings and the aspiration of bringing a change to this inequality. Feminist research encompasses further social change and knowledge, which confront the subordination of women (Osmond & Thorne, 2009, p. 592).

Feminists seek to trouble the categories of men and women, to examine the way they are established and to enquire about their belief. Feminism emphasises broadly the practices that are based on the creation of knowledge and the way in which the knowledge functions in the way it does (Bacchi & Bonham, 2014, p. 173). The central focus of feminist theory, at least from a post structural perspective, is on the processes of “gendered subjectification”, the traditional and particular activities whereby one is exposed to the informal regimes and regulatory frameworks through which gendered men and women are developed and the social context is established (Foucault, 1980, p. 239). Gendered subjectification is present in all spheres of the society and thus increases the presence of gendered individuals. This may have an influence on the relationships amongst men and women in higher education institutions. Just as there is no single definition of feminism, there is no single feminist theory. Rather there is a wide range of feminist perspectives that are at times in tension with one another (Osmond & Thorne, 1993, p. 591). There have been different movements of feminism starting from first-wave feminism to postmodern feminism. Below I outline these moves.

#### **2.3.1.1 First-wave feminism**

First-wave feminism occurred in the nineteenth and the twentieth centuries in the United Kingdom (UK) and the United States of America (USA), and it concentrated on the advancement of equal agreement and property rights for women and disagreement with the possession of married women by their husband (Hawkesworth, 2006). The first-wave feminism is characterised by the fight for abolition of slavery, women’s suffrage, and abstinence (Baumgardner & Richards, 2010). At first, the goal of the first-wave feminism was to support a broad collection of entitlements to women, particularly the goal of winning women’s right to vote (Sharlach, 2009). Women were authorised to express their personal political identity (Moran, 2004, p. 228). Initially, the supposed suffragettes were renowned for allocating women to specific gender roles – such as caregiving (Van Bogaert & Ogunbanjo, 2009, p. 116). Yet, by the end of the nineteenth century, engagement concentrated mainly on political power (Kinser, 2004, p. 128). The first-wave feminism targeted women at giving them the right to vote.

### **2.3.1.2 Second-wave feminism**

Second-wave feminism depicted a new type of feminist undertaking, which emphasised social, cultural and political inequalities. The second-wave feminism was extended to granting economic rights to women by empowering them as individuals and to develop their skills and gain appropriate recognition (Moran, 2004, p. 228). Second-wave feminism started in the early 1960's and ended in the late 1980's and it was an extension of the suffragettes in the UK and the USA (Hawkesworth, 2006). The first-wave feminism concentrated on rights, whereas the second-wave feminism concentrated on eradicating bias and favouritism. Second-wave feminism has continued subsequently and coincides with the third-wave feminism. Feminists have argued that, as no one possesses feminism, "the worst struggles within feminist politics were effectively about ownership and colonization" (Gillis, Howie & Munford, 2004, p. xv).

### **2.3.1.3 Third-wave feminism**

Third-wave feminism started in the 1990s, because of disappointments caused by the second-wave feminism (Hawkesworth, 2006). Third-wave feminism involves a different discussion to understand gender relations (Mann & Huffman, 2005, p. 56). Third-wave feminism that focused on individual conversations and traditional criticism has occasionally obstructed works to structure a political plan (Moran, 2004, p. 228). Third-wave feminism has the tendency to glance with scepticism upon statements that the domination of women is methodical (Budgeon, 2011, p. 282). The third-wave feminism gets to confront or bring into question the definitions of the second-wave feminism, which emphasises the experiences of upper middle-class white women. A post-structuralist understanding of gender and sex is "central to the third-wave" of feminism. Being empowered in the third wave of feminism builds women confidence and enhances the ability to make choices (Shugart, Egley Waggoner & Hallstein, 2001, p. 195). This means that empowerment in the second-wave feminism is collective, whereas in the third-wave feminism, it is individualistic.

### **2.3.1.4 Strands of feminist thoughts**

Feminist theory provides explanations, including that the discrimination of men against women is built upon the fact that gender is a social construct defined and

enforced by social processes and by the performance of behaviours of men and women. Within the various waves of feminism, women scholars have sought to understand and locate practices, structures and systems that impact on women's experiences and subjecthood. Feminism has made people question roles and power that are often associated with gender (Heywood, 2000, p. 58). Feminism explores gender inequality in politics, power, rights, interests and sexuality through discrimination, stereotyping, objectification, domination and patriarchy. Thus, there are various theoretical strands of feminism, each emerging out of epochs of women's struggles, that seek to understand and explain women's lives and experiences as they relate to the social order that exists. In the sections below, I have elaborated on only some feminist strands that exist.

#### **2.3.1.4.1 Socialist and Marxist feminism**

One of the most influential theoretical advances in feminism has been socialist feminism. This theoretical framing emerged within the second wave feminist period and links the domination of women to Marxist thinking about domination and labour. Some feminists relate the unequal position of women in the workplace to that in the household (Hawkesworth, 2006). Socialist feminism recognises how prostitution, household work and childcare are allocated to women and that these women are dominated by a patriarchal structure that undervalues women and the considerable effort they make (Hawkesworth, 2006). Socialist and Marxist feminism perceives culture as only one part of the socially constructed culture of feminist battle (Gimenez, 2000, p. 22). Socialist-Marxist feminists understand the importance of working with men and other groups as discrimination against women affects everyone in a capitalist structure.

#### **2.3.1.4.2 Liberal feminism**

Another strand of feminist theorising, which emerged within the second-wave feminist movement, is liberal feminism. This strand of feminist thought asserts the equality of men and women through improvement in political and legal matters. This form of feminism is based on the perception of women as individuals who can achieve equality through their own actions and selections (Baehr, 2017, p. 7). Liberal feminism makes use of individual communications between men and women to bring improvement to the society (Begum & Sarmin, 2016). In liberal feminism,

each woman has the capacity of attaining equality without changing the structure of the society (Ukagba, 2010, p. 76). Liberal feminists agree to the notion that citizenship is established through participation in the labour market (Bittman, 2001). Many areas including education are important for liberal feminists (Ukagba, 2010, p. 76).

One consequence of both first-wave and the second-wave feminisms, was that the difficulties faced by women of colour and working class women were not being considered and that liberal feminists focused on the difficulties of the white women only (Holvino, 2010, pp. 3-5). Women of colour and working-class women were generally restricted to “secondary labour markets and to positions at the bottom of the organizational hierarchy” (Holvino, 2010, p. 5). Thus, Western feminists were encouraged to think beyond the boundaries of white, middle class and Western women (Mohanty, 1984).

Depriving women of civil rights, education and employment, as argued by liberal feminists, often cause gender inequality. Liberal feminists believe that female oppression and subordination are embedded in a set of cultural and legal constraints that hinder women to succeed in the public sphere (Enyew & Mihrete, 2018, p. 60). According to Tong (1992, p. 2), the society believes that by nature, women are less intellectually and physically fit than men and this leads to a discrimination against women in the academia and the labour market. Tong (1992, p. 2) further argues that liberal feminists do not agree with such unfair discrimination against women and that women should have equal possibilities as men in all spheres to succeed. Sandel (1984) claims that individual rights comprise a framework within which all individuals can choose their own separate goods and thus, the “right” must be given priority over the “good”. Liberal feminism also called as mainstream feminism or egalitarian feminism, claims that “all people are created equal and should not be denied equality of opportunity because of gender” and that women empowerment can be achieved by integrating women into significant and equitable roles (Lindsey, 2015, p. 17). Liberal feminism works to incorporate women into desirable social positions and employment opportunities.

Being one of the “Big Three” schools of feminist thought namely liberal feminism, Marxist or socialist feminism and radical feminism (Maynard, 1995, p. 259), liberal feminism is often contrasted with Marxist or socialist feminism and radical feminism. Liberal feminism focuses on individual rights and equal opportunities whereas Marxist or socialist feminism concentrates on capitalist exploitation of women’s labour and radical feminism attempts to formulate new ways of theorising women’s relationship to men such as violence, heterosexuality and reproduction (Maynard, 1995, p. 260). As such, liberal feminists may subscribe to a variety of feminist beliefs and political ideologies.

#### **2.3.1.4.3 Post-structural and postmodern feminism**

One of the most important feminist strands to emerge out of the third wave of feminism is post-structural feminist theory. Post-structural feminists sustain that the notion of difference is a powerful instrument to defeat patriarchy, discrimination, oppression and inequality (Hawkesworth, 2006). Post-structural feminists work within post modernity, particularly its framing of the existence of a multiplicity of truths. The main argument is that gender is created through language.

Feminist post-structuralism tries to find out the problems that exist in male and female, to find out how gender is developed. It emphasises discursive and governing practices. The main emphasis of feminist post-structuralist theory lies within the developments of gendered subjectification that consists of processes whereby an individual is exposed to discursive and governing practices, thus creating gendered individuals (Foucault, 1980).

Inspired by Foucault’s thinking (1980), post-structural feminist scholars studied how language and material discourses produce and reproduce gendered assumptions, through the institutionalisation of stereotypical and normative discourses characterised by women’s subordination. Thus, as stressed by post-colonial research, third world studies, queer theory and black feminism, a proper analysis of normative discourses cannot exclude issues such as age, class, religion, disabilities and sexual orientation.

### 2.3.2 Adopting liberal feminism

In this study, I have chosen liberal feminism as the theoretical framework informing this study because it provides insights into the various ways in which institutional cultures and practices inform women's experiences, especially as women expect to achieve equality in all fields when women are equally educated as men (Mishra & Bohra, 2019, p. 640). Liberal feminists support legitimate democracy and hold "that the internal workings of arrangements of associational life should be just because this is necessary if society is to have a just basic structure" (Baehr, 2017, p. 2). Liberal feminism puts emphasis on equality in gender practices, and states that women should be treated as full humans rather than only sex objects (a key tenet of patriarchy). Liberal feminists also note that society has the tendency to discriminate against women because the society is blinded by misleading beliefs that women are fragile both physically and intellectually by nature (Mishra & Bohra, 2019, p. 641). Due to the gender order prevalent in society, women tend to be over-represented in occupations such as service professions and pink-collar work, but experience dramatic under-representation in STEM occupations (Thompson, 2003, p. 10). Liberal feminists argue that these arrangements are socially contrived to deliberately position women in a position of inferiority. Liberal feminism considers the state as an instrument that can be used to create equal opportunities for women and to establish gender equality through legislative reform and anti-discrimination laws (Arat, 2015, p. 676). Liberal feminism is thus the most suitable for this study as it stresses on equal opportunities for women's education, economic participation and integration into all male institutions.

Mills (1984, p. 302) notes that, in the context of education, inequity in educational accomplishment can be explained by the privileges that men enjoy socially in such a patriarchal institution. Mills (1984, p. 302) further claims that any psychological or intellectual difference that has been socially constructed between men and women is the result of men's higher performance than women and is not associated with nature. Liberal feminists argue that political structures must "respect the fundamental equality of citizens and their right to determine for themselves those things that are in their own best interests" (Graham, 1994, p. 1).

The choice of the liberal feminism lens for this study was grounded on three arguments. Firstly, the initial problematisation factored in existing contextual literature, which gestured to how practices and structures in formal educational spaces contradicted legal and political provisions (Bunwaree, 1997). The discussions around these issues are necessarily framed within the liberal feminist tradition because of the predominance of issues of equality of opportunity and discrimination against women. Thus, the problem identified was to examine how these processes working against equity were set up, sustained and legitimised in educational spaces via the medium of personal experience. Personal experience was a means to understand the wider systems in place and not the subject of the study, which is why a critical feminist paradigm was not used.

Second, the contextual historical reality of Mauritius inherited a more European, Western approach which explains why gender issues are treated from the lens of the individual against the state rather than considering it from the multi-layered perspective of intersectionality allowing for ethnicity, class and culture. The problem of under-representation of women in engineering is primarily a debate around individuals, irrespective of culture, race and class, being denied access to what should be an acquired right. I choose to move one step away by asking the question of whether there may be forces operating within the very belly of the system which compromise the legal political albeit liberal rhetoric. I am through this study, making a move away from the liberal to the critical by showing that even if the initial problematisation is within the liberal perspective, issue of culture and class would naturally require the integration of more critical perspectives. But I relied on the data to do this rather than take this stance as our starting point.

Third, I am conscious of the current re-theorisations of gender acknowledging more of the Southern Voices, the African and Asian women which, it is claimed, are not represented within the liberal feminist tradition because the latter looks more at the relationship between the individual and the state and does not recognise that this individual is nested within “intersections.” I am pointedly aware of the criticisms, which, have descended on liberal feminist for the apparent obliteration of race, class, and culture from the equation but the methodology selected has enough open-endedness and latitude to encourage these perspectives to emerge.

The outcomes have not been disappointing because in the closing chapters of the thesis, on the basis of the empirical findings, I reflect on how the experiences speak to how power and privileges unequally attributed work against the liberal feminist agenda of equal representation and success of women in engineering programmes.

Liberal feminism was appropriate for this study as it helped also in unpacking the perceived supremacy of male (or men) in the engineering field, including the cultural and systemic dimensions that aid this perceived supremacy. This was critical in studying the gender regimes in higher education institutions, particularly those practices and actions that lead to the discrimination against and unequal treatment of girls and women. Liberal feminist theories use the following lenses to explain why gender inequality occurs; namely gender socialisation, gender difference and established structural practices.

#### **2.3.2.1 Gender socialisation**

Liberal theorists suggest that women are kept at a position of disadvantage through gender socialisation. They argue that the socialisation process during childhood establishes the gender of children (Shawver & Clements, 2015, p. 558). During the socialisation process, at a young age, children are taught the difference between a boy and a girl (Crespi, 2003, p. 5). The key tenet of socialisation is premised on the idea that differences in gender occur when men and women have various attributes (Nasution & Jonnergård, 2017, p. 333). Ideas around gender are promoted by parents, family members, community and institutions such as religious institutions, schools, media and law (Harro, 2000). It is through these early socialisation processes, as detailed by the Harro's cycle of socialisation (1984), that young people grow up believing that their gender differences dictate a natural difference favouring man. The second-wave feminism wanted to dishonour the sexist belief that sought to suggest that women have the tendency to perform poorly in 'male-dominated fields', and that women were not intelligent enough. Of course, as feminist scholars have shown, these sexist assumptions have no value or legitimacy, as it is often the structural impediments present in institutional settings that impact on women's abilities to succeed in occupations traditionally reserved for the employment of men (Thompson, 2003, p. 14).

Gender socialisation thus contributes to the process by which men and women become conscious about the norms and behaviours associated with their sex. In a patriarchal institution, gender difference is outlined with the difference in power and privileges associated with men and women that encompasses any individual's life and that is communicated to others through the process of socialisation (Ganesh, 2018, p. 7).

#### **2.3.2.2 Gender difference**

Another position adopted by some liberal feminists is the belief that female/feminine traits should be recognised, and the relational characteristics associated with women should be acknowledged (Thompson, 2003, p. 22). This view holds that the problem that young women face in education is the disparity that exists in the school culture and socially constructed feminine culture. A gender-neutral education, instead of a gender-sensitive education, should be provided to women, as women are intellectually equal to men without being identical. This liberal view holds that equality cannot be understood in terms of sameness (Thompson, 2003, p. 22). When liberal feminists see both adult men and women as individual persons, they do not reject the ineliminable differences between them or the roles they play in the structure of the social institutions, they only want to ascertain that respect is maintained (Graham, 1994).

#### **2.3.2.3 The role of structure**

Liberal feminists work within the existing social structures of society due to the reliance of liberal feminism on individualism. They argue that there should be educational strategies that support a fair participation of women in educational powers and structure. Education is a major tool because, as Middleton (1989) argues, liberal feminism can be attained only if the attitudes of every individual change. Thus, liberal feminism encourages teachers to inspire women to study male-dominated fields and to take up a career in such fields. Liberal theorists address many areas related to women in employment, their fight for equal pay for women and elimination of sexist conduct and discrimination towards women (Sultana, 1990, p. 12).

## 2.4 Section 2: Understanding gender as a concept of feminist engagement

### 2.4.1 Gender attributes and gender roles

In *The Second Sex*, published in 1953, philosopher Simone de Beauvoir famously remarked that “one is not born a woman, but, rather becomes one” (De Beauvoir, 1953, p. 14). According to De Beauvoir (1953, p. 17), gender is constructed, and “one becomes a woman” due to the cultural compulsion to become one. This is the reason why she defined the self as “otherness”. Sociologists describe gender as the responsibilities and beliefs ascribed to men and women in a society. Whatmore (2016, p. 5) argues that gender has been constructed socially, thus resulting in the experience of being a man or a woman. According to Butler (2011, p. 8), gender is constructed culturally, and it does not have any relationship with the sex of an individual. Hence, gender is a social and cultural concept related to assigned gender roles and values instead of a biological concept related to sex.

Between 1960 and 1970, sex and gender started to be considered as two different concepts. Sex was a concept that is related to the biological aspects of an individual whereas gender is achieved through psychological, cultural and social involvement. According to Budgeon (2014, p. 317), the notion of gender was inserted into the language of western feminism – an important approach for stimulating and changing disparate social relationships. Gender theory has contributed to a large extent to undoing important differences between men and women (Budgeon, 2014, pp. 317-318). The introduction of the concept of gender into the dictionary of feminist thought has led to further understandings, such that the focus on the concept of sex has led to deeper reflections on gender difference (Connell, 1987). According to Butler, gender is performed according to the cultural environment and gender performance does not correspond with sex (Butler, 1988, p. 524).

Gender is usually physically referred to as the qualities related to being a male or a female. Gender attributes, as established by Deaux and Lewis (1983), comprise masculine and feminine characteristics, masculine and feminine role behaviours, masculine and feminine physical characteristics and masculine and feminine occupations. The attributes associated with women are generally caring and nice whereas the attributes associated with men are powerful and strong (Lips, 2017, p.

11), which resonates with Connell's (1987) identification of attributes of masculinity - strong, competent, dominant and authoritative (Connell, 1987). Conversely, femininity comprises traits such as "empathy, sensitivity, loyalty, and a caring disposition, traits that are stereotypically attributed to women" (Heilman, 2012, p. 129). Commonly held assumptions are that women appear to be deficient in their characteristics (Heilman, 2012, p. 114). Dominance is usually judged socially as acceptable to be practised by men whereas weakness is associated with women (Rudman & Phelan, 2008). The society usually associates men and women each with specific characteristics, each attribute having a specific position. In the family, the husband is usually given the role of the breadwinner whereas the wife is assigned the role of caregiver (Bear & Glick, 2016, p. 1). It is through these social roles that men and women are expected to conduct themselves, often with rewards and punishments to ensure conformity to the social norm (King, 2019, pp. 5-6). As a study that sought to understand the operation of gender regimes within institutional settings and subject fields that support men, a focus on gender attributes and gender roles became a critical tool for theoretical understanding as the social and economic relations existing between men and women in a household, society or workplace are generally organised and ordered in alignment with patriarchy. It therefore became critically important to adopt another more focused theoretical tool, to understand the type of regimes that exist in the selected Mauritian higher education institution. It is for this reason that Connell's theory on gender regimes was adopted.

#### **2.4.2 What is a gender regime?**

The concept of gender regimes originated from Connell and refers to as a dynamic pattern of gender relations in a specific institution (Connell, 1987, p. 120). Gender relations, according to Connell (2006, p. 839) are not simply a shapeless heap of data but are found in all spheres of life, including organisations. The general form of gender relations within an organisation is described as its regime (Connell, 1987, p. 16). Connell (2009, p. 72) also focuses on the connections between and amongst men and women at different stages – individually, in groups and in organisations – suggesting that gender relations are established by arrangements of practices that are constantly dynamic. In this context, gender relations and gendered processes can either enhance or discourage gender equality. Determining whether gender relations and gendered processes do so, relies on assessing the types of gendered constructions

operating in any organisation. Further, Connell (2009, p. 72) clearly explains that, to be able to understand gender relations, one needs to move away from the dichotomy of sex difference between men and women. Connell (2002) argues that an individual does gender in an institution in line with established practices associated with the following four dimensions:

- (i) Gender division of labour;
- (ii) Gender relations of power;
- (iii) Emotion and human relations; and
- (iv) Gender culture and symbolism.

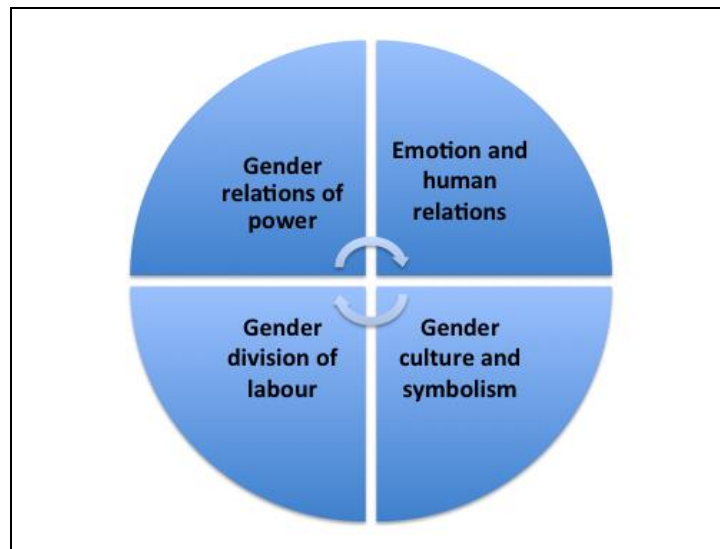
The arrangement of the above four dimensions and the arrangement of gender relations is thus defined as a gender regime (Connell, 2009, p. 72) and the arrangement may vary according to institution. However, many researchers have tried to elucidate the meaning of gender regimes. For instance, Broomhill and Sharp (2007, p. 7) describe gender regimes as the relations illustrated through power between men and women in any institution and that is based on social and cultural practices, whereas Butler (1993, p. 21) describes gender regime as one in which gender is given a hierarchy. According to Sainsbury (1999, p. 5), “a gender regime is an established group of rules that allocate specific tasks and roles to men and women”. “The gender regime is made up of a range of social practices, each of which has elements of ideology built into it, but which are most obvious as material practices and structures that constrain and enable social interaction on the basis of the sex and gender of social actors” (Ransome, 2010, p. 276). In line with what Ransome states, the social practices and ideologies have attributed to each gender a specific role that may enhance or hinder social interaction, thus creating either positive or negative gender regimes in any organisation. In line with the above literature, the researchers Connell (2009), Broomhill and Sharp (2007), Butler (1993), Sainsbury (1999) and Ransome (2010) state that gender regimes constitute power relations between men and women. Such power relations between men and women are considered as gender relations that are present in organisational contexts. The organisations vary from domestic to public, that is, the organisations can be the home, school, work or state.

All institutions that are constructed are gendered (Lindsey, 2015, p. 2), thus creating gender regimes. Gender is implanted in any institution, including educational institutions, and is practised through different levels: labour, power and others, and all these together form a regime (Connell, 1996, p. 213). An educational institution's general gender regime usually strengthens gender separation although there are some practices that diminish gender difference (Connell, 1996, p. 213). Gender dichotomy in an institution may have an influence on the gender relations that exist within the organisation and multiple regimes may exist within a single institutional setting. This study aims at understanding the gender relations on the learning experiences of female engineering students in a higher education institution. Educational institutions are conceptualised in terms of opportunities and limitations that create educational inequalities (Hadjar & Gross, 2016, p. 3). Educational institutions play a fundamental part in finding out female students' interests in STEM fields and in providing equal chances to women to engage in STEM education. Teaching staff, peers, curriculum, materials and equipment, which altogether form the overall learning environment, are important to ensure female students' benefit from and commitment to STEM education.

The four dimensions of Connell's theory of gender relations (2002) are expanded in greater detail below. Gender regimes rely on the gendered structures existing in a specific organisational context, from households to educational institutions. The presence of the gender regimes in a higher education institution may hinder the presence of more women in education, which is the focus of this study.

#### **2.4.3 Unpacking Connell's gender regimes**

As alluded to above, this study was guided by Connell's theoretical analysis (2002) on gender relations, which is a seminal piece of work and from which other authors have extended their ideas. Connell's (1987) theory of gender relations, which was revised in 2002 to encompass four main dimensions of gender relations, as mentioned above: gender division of labour, gender relations of power, emotion and human relations and gender culture and symbolism as shown in Figure 1, was selected to supplement the liberal feminist framework adopted for this study.



**Figure 1: Lens of the theoretical framework**

The first dimension of Connell's theory of gender relations is the gender division of labour. This dimension signifies the manner in which work is divided based on gender. This dimension comprises the headcount of men and women working in the organisation and the allocation of tasks by gender (Sümer, 2016, p. 19). Moreover, this dimension also encompasses the ways in which tasks and roles are allocated to men and women. In the education sector, gender division of labour is manifested amongst teachers; female teachers usually teach subjects such as literature, languages and domestic science and men teach subjects such as science and mathematics (Connell, 1996, p. 9). Such a gendered allocation of subjects to teachers would increase gender inequity. There could be gendered work specialisation at the workplace. For example, in Mauritius, women tend to teach lower classes at schools and the number decreases as the level of classes goes up. In 2012, female teachers made up 72.2% of the teachers in primary education (UNESCO Institute of Statistics, 2015) compared to 59.3% in secondary education. Higher classes are usually associated with prestige, and prestige is attributed to men particularly when they teach science subjects. However, this goes beyond recruitment and is also embedded in the ways in which task allocation is assumed. For example, in a university, there could be practices that are grounded in the view that male staff get to teach what could be constructed as more demanding modules or are assigned classes that are considered to be more difficult to handle intellectually. There could be situations where the same number of male and female staff conceals a range of stereotyped views of what male and female staff can do.

The second dimension of Connell's theory of gender relations (2002) is the gender relations of power that lead to male dominance. This dimension includes power, authority, control and force, which are implemented through organisational hierarchy and legal power, depending on the gender of the individual. Gender relations of power are inscribed with an organisation and are related to power. Gender relations of power have been documented as favouring male dominance, in terms of the violence that is produced either individually or collectively. In the education sector, gender relations of power are manifested among academic teaching staff through authority and decision-making, and among students through dominance and harassment (Connell, 1996, p. 9). Like the previous dimension, gender relations of power are described by how men and women connect to each other in practice. In this study, gender relations of power particularly concern the relationship between academic teaching staff and female students, and the relationships between male and female students, and how power is manifested in these relationships through the possible monopoly of privileges and oppression. In an educational context, gendered power relations can be manifested by the differential higher authority accorded to men or that men claim for themselves by relating to women in the workplace in particular ways, such as recruitment, organisational hierarchy and social space.

Generally, studies using the perspective of gender relations of power study how, within an organisation, recruitment is carried out and how there is inequality of the number of men and women in senior positions. In a higher education institution, the gender relations of power will be the number of female academic teaching staff employed as senior staff and the ability to participate in the decision-making processes. Furthermore, many studies also focus on how the nature of the occupational hierarchy is defined. Gender relations of power are related to the hierarchy existing in the institution. For example, higher management positions may be arbitrarily assigned to men on the unquestioned assumption that they are more cut out for such positions (Stojanović et al., 2019, p. 4). Gender relations of power are studied to uncover these institutional assumptions and beliefs that may perpetuate such practices. For instance, gender relations of power may be present between academic teaching staff and students where academic teaching staff have authority over students.

The third dimension of Connell's theory of gender relations is emotion and human relations. This dimension is associated with emotional attachment to same sex or cross-sex groupings between men and women (Connell, 2002) and the emotions could be love, affection or solidarity and hatred, hostility or abuse. In an organisation, men and women may show support to each other of their own gender. The emotional attachment may be related to the practice of same sex groupings and cross-sex groupings amongst peers, demonstrating a sense of solidarity amongst themselves. Emotion and human relations may also relate to the trust and solidarity developed between female students and female academic teaching staff.

The fourth dimension of Connell's theory of gender relations is gender culture and symbolism. This dimension defines gender identities, prevailing beliefs and attitudes about gender. The characteristics of this dimension are related to the understanding that individuals have about themselves, their colleagues and the organisation, with regard to gender and gender equality. As noted elsewhere, gender is often associated with sex. Such an association makes women incline towards maternity, family and caregiving and be reluctant to participate in the public sphere and institutional decision-making. This dimension reveals widespread patriarchal beliefs and how they have gender roles and gender attributes. Connell (1996, p. 9) argues that educational institutions tend to imitate and adopt the symbolisation of gender from the culture, although they have their own systems. Women having to wear dresses or skirts and being excluded from activities such as playing football appear to be the most common ways in which schools reinforce or develop their own gender culture symbols. Moreover, Connell (1996, p. 9) also states that education is knowledge but unfortunately, it is gendered, as some subjects are reserved for men.

Although the four dimensions of Connell's (2002) theory of gender relations are separated, they operate together. They are intertwined and continuously intermingle with each other (Siddiq, Gochyyev & Wilson, 2017). The social practices work together in creating gender in an organisation. In this manner, the gendered processes of an organisation are identified. I thus adopted Connell's (2002) theory of gender relations on gender regimes to analyse gender relations in the engineering field in a higher education institution. An educational institution is an ideal

organisation for the study of gender regimes, as it includes all the four dimensions of Connell's theory of gender relations (2002). Equal opportunities to access higher education and to employment are 'supposed' to be overarching in student enrolment and staff recruitment policies in Mauritius. However, in practice, especially in the engineering field, there are clear indications that the presence of gender regimes ensures the under-representation of female students in engineering.

#### **2.4.3.1 Mapping Connell's gender regime and liberal feminism**

I have used a liberal feminist theory to explore the learning experiences of the female students in relationship to the gender regimes present in a Mauritian higher education institution. The additional adoption of the gender regimes theory by Connell (2002) helped in terms of analysing the division of labour among the academic staff, gender relations of power among the students, emotions and human relations among women and the gender culture and symbolism that existed in the class. The feminist theories enabled me to unpack the multiple and interrelated student, faculty, and institutional cultures that influence the learning experiences of female engineering students. Adopting a feminist theory as my theoretical framework enabled me to explore the statements and experiences embedded in power relations, which form part of the gender regimes within the higher education institution in relation to femininity and masculinity.

A gender identity can be defined as masculine or feminine (Burke, Stets & Pirog-Good, 1989). Feminine and masculine identities are created based on society rather than on the sex of the individual (Stets & Burke, 2000, p.1). Femininity and masculinity do not exist separately, because their existence depends on each other, although masculinity denotes power and control (Stonyer, 2002, p. 393).

According to Connell (1995, p. 71) masculinity is about gender relations, practices, personality and culture. Connell (2000, p. 29) further argues that masculinity is configured within an organisation and is, therefore, institutionalised. Van Hoven and Hörschelmann (2005, pp. 10-11) argue that masculinity is above biology and sex. According to Mac an Ghaill and Haywood (2006), masculinity and femininity are no longer considered as inborn types of sex differences but as behaviours that have been instilled and acquired. According to Connell, masculinity is usually associated with

“honour, prestige and the right to command,” material wealth and state power (Connell, 1995, p. 82). Physically, men are motivated to encourage hegemonic masculinity to protect their governing position over women (Coles, 2009, p. 31). Masculinity revolves around hegemonic masculinity, which, according to Connell (1993, pp. 90-92) is “a question of how particular groups of men inhabit positions of power and wealth, and how they legitimate and reproduce the social relationships that generate their dominance”.

Gramsci’s (1971) concept of hegemony although initially meant to inform political understanding, has been used in Connell’s formulation of hegemonic masculinities. However, a case is being made for a closer alignment as Gramsci considers hegemony as positive hegemony. Initially, he describes hegemony as being based on both force and consent, such that when force has to be deployed, it receives consent from civil society.

Burawoy’s (2003) distinct definition of hegemony and the possibilities, which it offers, acts as a guide to operationalise hegemonic masculinity. However, Burawoy’s definition also protects us from the “pessimistic tendency to reduce hegemonic masculinity to behavioral and discursive legitimation of patriarchy” (Yang, 2020, p. 325). Following Burawoy’s (2003) interpretation of hegemony, Yang (2020, p. 325) states that hegemonic masculinity focuses on the agreeable relationship of domination between dominant masculinity and subordinate masculinity. Thus, hegemonic masculinity is the dominant masculinity present in a hegemonic and in a hierarchy of masculinities, subordinating other types of masculinities with an incorporation of force and consent. When force is adopted, most of the followers of the gender regime consent. Even those who represent subordinate masculinities and are conscious of their subordination may still consent to the patriarchal dividend. Therefore, according to Hennen (2008), even subordinate masculinities with rebellious characteristics can contribute to the existing hegemony.

Hegemonic masculinity describes “the persistence of male power and the potential for social change” (Duncanson, 2015, p. 2). Most often, hegemonic masculinity embraces new practices to allow some men to maintain power over others (Messerschmidt, 2015). Hegemonic masculinity symbolises and enacts power over

other masculine identities as well as over women (McVittie, Hepworth & Goodall, 2017, p. 6). In Western societies, the ideal hegemonic masculinity is considered 'macho', being "assertive and aggressive, courageous, almost invulnerable to threats and problems, and stoic in the face of adversity" (McVittie, Hepworth & Goodall, 2017, p. 7). Thus, masculinity is constructed by the behaviours of man depending on culture, race and ethnicity and age and some men have the tendency to benefit from the general subordination of some women.

In his critique of Connell's concept of hegemonic masculinities, Demetriou argues "men do not constitute a homogenous or internally coherent bloc" (2001, p. 340). However, Paechter (2006, p. 257) positions femininity as being without power and this also concurs with Roy (2013, p. 25) who associates failure with femininity and powerlessness. According to Singh (2017, p. 110), femininity theoretically is all about what masculinity is not and which "incompetent" masculinities may fall into. Singh (2017, p. 111) further argues that hegemonic masculinity is thus at an unreachable height where it can easily effeminate, incorporate and oppress. According to Moller (2007, p. 266), Connell's work on hegemonic masculinity thematises power by equating power with domination and by attributing this power to typical men. Although, all men may not practise power, many may benefit from it through the patriarchal dividend. However, Brown (1995, p. 194) indicates that masculinity operates through the rejection of power and privilege. According to Moller (2007, p. 266), men and women subject themselves to the restrained modes of contemporary power when power is being referred only as domination practised by some men.

Connell (2000, p. 10) indicates that gender relations form an identifiable pattern or system and that there is not only one pattern of masculinity. Connell (2000, p. 11) states that masculinities are described collectively in culture and are continued in institutions. Connell (2000, p. 12) does not agree with the idea that men's bodies "determine the patterns of masculinity" and that men are the authors of masculinity. Instead, men are followers of masculinity and they are not designers of masculinity. Based on Connell's statements about the patterns of masculinity, I have used the term hegemonic masculinity because hegemonic masculinity is a pattern of masculinity, which is created by an institution. In this study, hegemonic masculinity

being performed by the male students is formed by the regime present at the higher education institution.

Connell (1987) claims that femininity is formed in relation to the image of the female body that results in Connell's anti-essentialist view of male and female. Furthermore, Connell (1987, p. 187) also states that all the types of femininity are established according to the context of "subordination of women" to men and "dominance of men" to women, thus creating no position of hegemonic femininity among women. According to Finley (2010, pp. 360-361), the notion of hegemony/dominance is related to power and femininity cannot be linked to hegemony as women have inadequate existing power connections over other women and therefore, this gave rise to the concept of emphasised femininity. Emphasised femininity describes the arrangement with the most cultural support and is organised through obedience with gender relations. Heterosexuality is fundamental in emphasised femininity and it consists of the interests and needs of men through weakness, delicateness, tolerance of marriage, sexual interest and motherhood (Connell 1987, p. 188). As Connell (1987) suggests, in a male-dominated social context, femininity means subordination in relation to masculinity. What gets considered as masculine and feminine depends on the dominant roles, values and norms prevalent in a social set up at a given time.

The centrality of patriarchy and masculinity is being decentralised with a gender difference in interests in male-dominated fields such as STEM (Diekman, Weisgram & Belanger, 2015, pp. 57-58). This process is taking place gradually in engineering fields at a higher education where female students have started to engage in different engineering fields (Huyer, 2015, p. 91). However, the engineering fields in higher education are still male dominated (Huyer, 2015, p. 85). The three clusters of educational settings, which are curricular experiences, classroom experiences and out-of-class experiences were examined, using liberal feminism and the gender regimes theory to explore them.

## 2.5 Chapter summary

This chapter started with the concept of feminism and some feminist theories. Different feminist researchers described the concept of gender regimes. One

commonality that was derived amongst the authors cited was that gender regimes constitute power relations that are considered as gender relations, and that these are present in organisational contexts. Thus, gender regimes are present in most types of organisations that include both male and female. The chapter has stressed the structure and arrangement of gender regimes in an organisation, including educational institutions. Finally, the chapter presented the theoretical framework, which assisted me with data production and analysis. The four dimensions of Connell's theory of gender relations were explained and served as a guide to the study. The chapter has examined Connell's theory of gender relations, which states the pattern of gender relations produced by the four dimensions of social life namely:

- (i) Gender division of labour;
- (ii) Gender relations of power;
- (iii) Emotion and human relations; and
- (iv) Gender culture and symbolism.

The next chapter offers a review of the literature in connection with the phenomenon studied.

## **CHAPTER 3: REVIEWING THE LITERATURE: GENDER AND STEM IN HIGHER EDUCATION**

### **3.1 Introduction**

This chapter maps the existent literature on gender regimes as they exist in educational institutions by identifying and critically examining the sub-concepts that inform current understandings of gender regimes. In particular, the chapter also maps out literature about how gender regimes operate within the context of STEM. This chapter does this as it seeks to locate existing gaps in terms of knowledge on gender regimes in a Mauritian higher education institution, particularly in the field of engineering.

This study examined the influence of gender regimes in shaping the learning experiences of female engineering students in a higher education institution. A critical analysis of literature clearly indicates that gender regimes exist in a variety of contexts, including educational contexts. Although much of the literature uses the lens of gender to explore patriarchy in a higher education institution, there is substantial empirical evidence that gender regimes in various manifestations influence a range of educational practices.

### **3.2 Structure of the chapter**

Section 1 examines the factors that hinder the representation of women in STEM subjects from a feminist stance. These included issues faced by women who are engaged in STEM career fields.

Section 2 discusses the learning experiences of female students studying engineering in higher education. The review focuses on international literature to address the global picture and to allow for articulations with the local scene. It reviews the literature on the concept of gender regimes in higher education.

Section 3 gives a description of the gender context in Mauritius.

### **3.3 Section 1: Reading women and STEM from a feminist stance**

#### **3.3.1 Problematising STEM career from a feminist stance**

The segregation of STEM education by society at large and by beliefs according to one's sex creates a challenge, and that gender segregation within STEM should lead to a formal investigation into the specific STEM organisation. Panetta (cited in Porter, 2011) argues that there will be a dearth of women engineers on the labour market because fewer women than men are studying engineering in higher education. According to Muro and Gabriel (2016), the setting that surrounds women decreases their confidence to participate in STEM occupations. Since childhood, women are socialised into engaging tasks that are perceived as soft while men do tasks perceived as being hard and technical, like fixing a bulb, especially in traditional families. It is not true that women are incapable of doing such tasks. They do not do so because the society associates women with soft tasks and men with technical tasks. Women are considered as feeble, which is the reason that women are not encouraged to take up a career in STEM (Muro & Gabriel, 2016, pp. 446-447), although this of course is not the case.

While empirical data may provide clarification to these gender variances in STEM, very little is identified about phenomena that may have an important role in changing the career paths for some women, for instance the experiences of women during their early years of schooling or the support they receive from teachers and parents (Banerjee, Schenke, Lam & Eccles, 2018, p. 288). This particularly relates to Mauritius. Some fields of engineering (for example, mechanical engineering) are seldom opted for by women (Stonyer, 2002, p. 392), due to the social processes in place, which, by design are geared towards such a positioning of women towards engineering. The social processes often lead women towards the society and its requirements (for example, in the case of Mauritius, civil engineering would be one of the requirements of the country) and to adapt to collaborative learning (Stonyer, 2002, p. 392). By investigating the experiences of female students, it is feasible to name and structure the conditions that facilitate and restrict how engineering characteristics are established.

In Dryburgh's (1999) study, which was conducted in Canada with women enrolled in engineering as participants, the findings revealed evident instances of sexism that

are characterised by women as exclusions. The women in Dryburgh's study were hesitant to confess they had witnessed some forms of discrimination against women, often looking for approaches to defend the actions of their peers "as a form of group bonding and security within their 'in-group' " (Hall, Corb, Giannasi & Grieve, 2014, p. 74). Social regimes have resulted in such reactions from female students. For instance, they may indicate that the aim of the male students was not to discriminate against them.

### **3.3.2 Progress of women in STEM in developing contexts**

The under-representation of women in engineering does not mean that women are less competent than men. Due to the social processes, the presence of women in engineering, is less compared to men. In developing countries, women pursuing a career in STEM, struggle with societal discourses such as managing family and work life that construct leadership as male. For example, in Sri Lanka, "men expect women to behave like 'women,' submissive and compliant, and do jobs that comply with these characteristics" (Menezes, 2018, p. 131). A comparative view with developing countries like Mauritius such as Sri Lanka, may lead to the conclusion that developing countries may face specific contextual factors that have not been adequately problematised and researched. Patterns in developing countries show that gaps such as gendered ideas, gendered stereotypes, gendered discourses and an unfavourable environment persist. According to Bunwaree (1997, p. 310), it is important to encourage women to enter the traditionally male fields and the Government should find ways to encourage more female students to study STEM. In Mauritius, women are largely absent in key areas of decision-making (Gunganah, Ragobar & Varma, 1997). The exclusion of women from the development process of the country, would not only mean a drastic loss of human potential but would also have implications for democracy (Bunwaree, 1997, p. 315). It is important to enhance the participation of each citizen irrespective of gender "is not only a matter of economic efficiency arising from the necessity to employ effectively the important economic asset that Mauritians represent, but also a matter of equity" (Bunwaree, 1997, p. 315).

Bunwaree's (1997) study discusses the economy of Mauritius in the post-GATT era and how the qualities of women are not being utilised efficiently in the labour

market. Bunwaree (1997) proposes a reform of the educational system, which would enable women to integrate the labour market with higher levels of education and responsibilities, instead of assuming subordinate roles in the labour market. Bunwaree (1997) suggests that reinforcing school textbooks and gender roles in schools could eliminate job discrimination. Bunwaree (1997) indicates that discrimination exists in primary education, which feeds the possibility that such practice exists in higher education.

In STEM, research has proven the existence of gendered ideas and stereotyped beliefs that have questioned the competencies of women, thus preventing them from entering Science, Engineering and Technology (SET) (Erwin and Mauratto, 1998; Frenkel, 2008; Knights & Kerfoot, 2004; Phipps, 2007, cited in Walby, 2011, p. 6). The presence of more men than women entering SET, might influence the gendered culture of SET (Walby, 2011, p. 7) thus causing the low participation of women in STEM. The gendered nature culture and practices within educational institutions are also highlighted by Howe-Walsh and Turnbull (2016, p. 8), where women were found to be at work in a setting in academia that favours men and that has few women who could be their role models, which may explain the shortage of women in leading positions in STEM (Howe-Walsh & Turnbull, 2016, p. 8). Women may not be motivated to enter STEM because of the existence of the gendered culture that puts at stake their competences.

Gender in academic settings is associated with the field of study and as such men perform better in STEM disciplines whereas women perform better in art and languages (Madu, 2011, p. 3702). According to Walby (2011, p. 5), some women do less well in technical fields, which may explain their low participation. Women sometimes perform less well in technical/science related disciplines because of gender stereotypes and they are often influenced by attitudes that lead them to compromise their learning experiences and constrain their choice of study in higher education, thus preventing them from engaging in STEM subjects at a higher education (Smith, 2011). However, the under-representation of women in STEM could have more to do with their academic strengths than their weaknesses.

A gendered setting may prove to be a disadvantage towards women (Jasko, Dukala, & Szastok, 2019, p. 8) and characteristics that are linked with men or women in STEM could further strengthen the belief “that women cannot perform well in male-dominated” fields and demotivate them (Jasko, Dukala, & Szastok, 2019, p. 2). When evaluating gendered attitudes and behaviours in classrooms, students and educators believe that female students behave better and are more compliant than male students in classrooms, whereas male students are considered as troublesome (Mullola, Ravaja, Lipsanen, Alatupa, Hintsanen, Jokela & Keltikangas Järvinen, 2012). Taken together, findings have shown the discourse that uses stereotypes such as nice female students and intelligent male students in educational institutions (Butler, 2014). According to Butler (2014), the gendered stereotype in STEM in favour of men might not encourage female students to study STEM fields. In most cases, students are determined to study fields that they identify as relevant to their own self-concept.

Goal 5 of the Sustainable Development Goal aims to “achieve gender equality and empower all women and girls” (Hirsu, Hashemi & Quezada-Reyes, 2019, p. 1) and is of particular importance to countries where gender inequalities are prevalent. Gender equality in STEM guarantees that all individuals, irrespective of their gender, acquire expertise and prospects to assist equally from STEM (Fernández Polcuch, Brooks, Bello & Deslandes, 2018, p. 29). Gender equity in STEM education is an accepted goal within higher education institutions (Chavatzia, 2017, p. 11). In Mauritius, women’s absence in science subjects shows an increasing pattern all the way up the pipeline until higher education, especially in the engineering field (Higher Education Commission, 2020, p. 19). The harm is evident from upper secondary school level that is at Grade 10, among those female students who do not choose science subjects.

Despite the situation revealed by the above researchers, there are women who challenge the stereotyping by practising their femininity in ways that conflict with the gendered attitudes and beliefs about the STEM field being more apt for men than for women (Makarova, Aeschlimann & Herzog, 2019). It appears that women are perceived as hardworking learners (Pomerantz, Raby & Harris, 2017, p. 4) and this characteristic conflicts with the gendered associations of STEM (Master, Cheryan,

Moscatelli & Meltzoff, 2017, p. 94). Some women do not associate STEM fields with masculinity and some women do not regard themselves as being so feminine (Kessels, Heyder, Latsch & Hannover, 2014; Tobin, Menon, Menon, Spatta, Hodges & Perry, 2010). Therefore, associating femininity with the inability to succeed in STEM is inappropriate. Some women who would consider themselves as being talented or intellectual irrespective of their gender could perform very well if they work hard. Among the small number of women who enrolled in STEM fields, there may be drop-outs, thus leading to a small number of women pursuing a career in STEM. Consequently, gender inequality occurs in STEM.

The case is not different for Mauritius. Mauritian women enrol in the education system as equals to their male counterparts, for instance, according to Statistics Mauritius, in 2019, the pass rate of female students at the Cambridge Higher School Certificate examinations was 77.8 % (Statistics Mauritius, 2020, p. 12). Nonetheless, female students are persistently under-represented in engineering fields in higher education, for example in 2019, only 1.2% of female students joined engineering in public higher education institution (Higher Education Commission, 2020, p. 13). The reports published by Statistics Mauritius (2020, p. 13) and the Higher Education Commission (2020, p. 19) reveal that higher education enrolment in engineering fields follows the same patriarchal pattern, where the participation of women in engineering, as a field of study in higher education, is very low compared to that of male students. This shows that a gender gap exists in the STEM subjects in higher education in Mauritius. For instance, only 2.9%, 2.5% and 1.6% of female students of the total students at the Faculty of Engineering at the University of Mauritius in the academic year 2019/2020 were enrolled in BEng (Hons) Civil Engineering, BEng (Hons) Electrical and Electronic Engineering and BEng (Hons) Mechanical Engineering, respectively (Higher Education Commission, 2020, p. 28). This shows that female participation in some fields of engineering in Mauritius is very low, with a percentage of 1.2% of female students who studied engineering in public higher education institution (Higher Education Commission, 2020, p. 13). The figures show that female enrolment in some fields of engineering is very low as opposed to that of male enrolment. Mauritius is still a patriarchal society (Gokulsing & Tandrayen-Ragoobur, 2014, p. 620). In Mauritius, apprehensions regarding male domination, discrimination and patriarchy influence most women. Despite having a

career, women are required to assume the household and caregiving duties and are under-represented in positions of power (Ramtohul, 2020, p. 91).

### **3.3.3 Under-representation of women in STEM in education**

STEM, previously known as Science, Mathematics, Engineering, and Technology, has implications for human resources, as the majority of engineers are men and fewer women contribute to the engineering profession, which results in hiring more engineering professionals from other countries. STEM encompasses every segment of our lives. By making students familiar with STEM and by supporting and encouraging them to explore STEM-related concepts, students may develop a passion for STEM and confidently explore the possibility of having a career in a STEM field. Real-life situations in a curriculum may enhance teaching and learning experiences. A curriculum that is STEM-related helps students to connect to real life situations. Studying a STEM subject helps women to bridge the cultural and gender gaps that are found in engineering and science fields, by confronting the traditional gender roles.

STEM education is a vital component of a country's perceived competitive edge. However, experts are making a case to include Arts in STEM. For instance, Wilson (2018, p. 108) argues that a missing key set of creativity, that is an 'A' for Arts, is needed in STEM to foster a competitive and innovative workforce. According to Daugherty (2013, p. 10), there is a perception of elitism that is associated with arts subjects as only skilled and talented individuals succeed in arts. Although the arts community seems motivated to promote the inclusion of the arts in STEM, the evidence to support such claims is not yet robust.

STEM is important because it pervades every part of our lives and it is known as one of the main sources for innovation in a global economy. STEM education helps to connect the gender gaps and science fields by breaking the traditional gender roles. However, Dhesi (2011, p. 2) argues that there remain significant sex differences in educational subject choices. A research study conducted by UNESCO (2012, p. 21) reveals that, internationally, the participation of women in terms of enrolment in higher education equals or is higher than that of men in most regions of the world. Global gender figures mask an inherent gender bias in the choice of subjects, as

revealed in Organisation for Economic Cooperation and Development (OECD) (2011, p. 17). The continuing gender gap in STEM majors has encouraged an increased literature on the causes and consequences of this gap. Studies conducted by Kalaja (2012, p. 183), UNESCO (2012, p. 77) and OECD (2011, p. 5) show that male students continue to represent the majority of students in the area of STEM subjects, although women are the biggest beneficiaries of rising enrolment in higher education. In engineering areas, however, Madu (2011, p. 3702), Vijayakumar, (2012, p. 1), Hill, Corbett and St. Rose (2010, p. xiv) argue that female students are dramatically under-represented and thus it is believed that men perform better in STEM than women and women perform better in languages, arts and management than men. As stated by the above researchers, there are persistent processes that might discourage more women from doing engineering. There is a scarcity of studies on the participation of women in STEM in developing countries compared to developed countries (George-Jackson, 2011; de Melo Martin, 2013; Ceci, Ginther, Kahn & Williams, 2014; Sheltzer & Smith, 2014; Clayton, 2015). For the minority of women who opt to study STEM subjects in higher education, there are several intertwined causes of the gender gap in STEM. According to UNESCO (2017, p. 15), there is a pipeline issue when fewer women than men “choose to study STEM subjects” at secondary school and at higher education institution. Globally, the gender inequity in STEM education is alarming. Empowering women to enter STEM fields of study and persistence in STEM are imperative, as this will increase gender equity in STEM and help in diminishing existing gender regimes in STEM.

Female students may do equally well in STEM fields as in art and management related disciplines if they are provided with appropriate support. For example, providing a role model to women in STEM class would improve what was previously poor performance and feelings of not belonging to STEM, and enhance course grades (Herrmann, Adelman, Bodford, Graudejus, Okun & Kwan, 2016, p. 262). Stereotyped threats can harm the performance of women in STEM (Shapiro & Williams, 2012). Promoting women’s interest in STEM as meaningful is an important aspect to increase their persistence and performance in STEM. For example, even female seniors of academia in STEM are completely disrespected by their male juniors, as the society expects women to be primary caregivers (UNESCO, 2017). To increase performance of women in STEM, Diekman,

Weisgram and Belanger (2015, p. 58) argue that motivation is attached to success and is therefore a strong predictor of performance. Skills and abilities in STEM support students' performance, which then leads to an increase in their confidence and motivation (Rittmayer & Beier, 2008, p. 5). There is a lack of appropriate teaching and learning practices provided by higher education institutions to female students to enable the latter to increase their performance in engineering, which may be the reason why female students prefer to opt for arts and management.

Gender and other sociocultural factors are interconnected in the patriarchy embedded in society, where “societal expectation of women as primary caregivers encourage them to adopt career paths that are congruent with raising a family” (Boateng & Gaulee, 2019, p. 81). The presence of patriarchy in higher education institutions – classroom, peers and academic teaching staff – has also contributed to the low presence of women in STEM. Schultz (2011, p. 20) suggests that women shy away from engineering courses because of the competitive nature in the classroom that existed among their male peers and their teachers. Although women prefer working collaboratively to working on their own (Mosatche, Matloff-Nieves, Kekelis & Lawner, 2013, p. 22), women were found to possess equal skills and abilities as men in STEM (Wang & Degol, 2017). What is alarming in many parts of the world is not only the number of women achieving in their education but the insufficient educational routes accessible to them. For instance, women are considerably under-represented in STEM fields from primary education to onwards. Women seem to be unable to find motivation in STEM fields, particularly during their adolescence when they are in secondary school. The gender inequity in STEM becomes more visible in upper secondary education, as revealed in women's preferences of further studies in STEM. Most women do not choose science or mathematics in upper secondary education, thus preventing them from studying STEM subjects at a higher education. Sagebiel (2003) cited in Powell, Bagilhole and Dainty (2009, p. 414), claims that findings of many studies have shown that women have the tendency to move away from STEM, not because of their inferiority in their intellectual abilities and skills, but because of the gendered environment and chilly climate present in academia in favour of men (Powell, Bagilhole & Dainty, 2009, p. 414). Mills and Ayre (2003) note that there are several findings that show that many women do not experience a welcoming environment in SET courses, and it is most probable that other groups

who are in minority may find themselves in the same situation. Many students drop from STEM programmes because they claim that the environment is not supportive and they do not feel comfortable in such an environment (Thurairajah, Amaratunga & Haigh, 2007, pp. 4-5). The teaching and learning environment encourages hegemonic masculinity and patriarchy, thus marginalising women and discouraging the persistence of women in STEM.

#### **3.3.3.1 Portraying a masculine image**

Female students who enjoy doing STEM are often viewed as unfeminine by their family, male peers and academic teaching staff. Kessels (2005) found that women whose most preferred subject was physics were considered to be possessing more masculine characteristics than feminine characteristics by their peers. Studies have shown that stereotypes about STEM can make both men and women turn away from STEM, and the belief that women who are in STEM are unfeminine appears to be a disadvantage for women who wish to join STEM and are feminine (Kessels, 2015, p. 282). To be able to integrate in the engineering field in higher education, some female engineering students tend to imitate their male peers. As the research cited above has shown, women who are successful in STEM are considered by their male peers as being masculine (Kessels, 2015, p. 282). Unlike fields such as arts and management, engineering in higher education is a field that comprises fieldwork and practicals. Moreover, the hegemonic masculinity, which includes the gendered character of bureaucracies in educational institutions, comprises classroom dynamics and patterns of bullying. Therefore, women develop their personality to become efficient in the field by adapting themselves to the engineering environment. This adaptation can vary from masculine language to masculine physical attire.

#### **3.3.3.2 Increasing the presence of female academic teaching staff**

Dee (2006, pp. 70-71) states that, according to a survey conducted in 223 public schools in USA, both male and female teachers, have been found to treat female and male students differently in the classroom, although women achieve higher grades when taught by female academic teaching staff and men achieve higher grades when taught by male academic teaching staff. Dee (2006, p. 73) found that female science teachers play an important role in encouraging female students in STEM, as the female students were more confident during classroom's discussions. The learning

experiences of female students in STEM are coloured by academic teaching staff that stereotypically believe that STEM is more apt for men. Their pedagogical practices are gendered and can discriminate against women (Carrington, Tymms & Merrell, 2008). The interest of female students in STEM subjects is also influenced by female students' overall learning experience in educational institutions, particularly during early years of schooling, including STEM teachers, their teaching approaches and exposure to role models. Burke and Mattis (2007, p. 171) have observed that female engineering students praised female academic teaching staff, with nearly all students finding them helpful, encouraging and inspiring. Gender ideology, with normative gendered beliefs about gendered roles, may alter the relationships between academic teaching staff and female and male students.

According to Sonnert and Fox (2012, pp. 76-77), some young female students find it hard to attend engineering lectures due to the lack of female academic teaching staff as their prospective role models. According to Wang and Degol (2017), a wider exposure to female role models in STEM can inspire women to join STEM. The absence of role models and female teachers in STEM becomes an obstacle to women. As a result, the female students lose interest in doing the engineering field and, sometimes, this line of interpretation would envisage that only particularly confident, resilient and well-qualified female students would enter such fields. In the event that the female students continue with the engineering major, they would switch out of the field once they encounter difficulties with academic teaching staff. This may also be a restriction to enrol for an engineering programme, as these students do not get the expected encouragement from the academic teaching staff. According to Buabeng (2012, p. 134), academic teaching staff in STEM should teach mathematics and physics concepts well to encourage more women to study such fields. This inequality in the number of academic teaching staff influences the self-selection process of a specific field of study and may then lead to attrition. According to Sithole, Chiyaka, McCarthy, Mupinga, Bucklein and Kibirige (2017, p. 55), "science students drop out when their hopes for academic success fade". Academic teaching staff are considered to have an especially prevailing impact on students' self-beliefs and inspiration for STEM (Gunderson, Ramirez, Levine & Beilock, 2012; Li, 1999; Tiedemann, 2002). According to the study of Nugent, Barker, Welch, Grandgenett, Wu and Nelson (2015, p. 1083), in which data were

collected from 800 students aged from 10 to 14 who attended robotics camps from 19 states in USA as part of a STEM education project, it was shown that the influence of support from academic teaching staff directly influences youth's interest in STEM. Expectations of academic teaching staff may have an influence on students' confidence and competence. The presence of female role models in STEM improves the participation of women in STEM and women's views towards STEM careers are also enhanced (Cheryan, Siy, Vichayapai, Drury & Kim, 2011). Women may be unwilling to have a career in STEM due to a dearth of women (colleagues and mentors) amongst whom they can find a support system (Wang & Degol, 2017). Besides the presence of female academic teaching staff in STEM, the influence of academic teaching staff in STEM and life-style principles also has an important part in women's choice of fields of study.

Gender functions as one aspect of the socio-cultural setting in educational institutions. In the engineering field, gender is highlighted, particularly in the teaching and learning process (Dym, Agogino, Eris, Frey & Leifer, 2005, p. 107). This does not mean that gender is the only aspect that academic teaching staff need to think about in their teaching but Helms Mills and Mills (2009, p. 171) propose that gender is indeed a crucial aspect. This claim occurs because gender is a set of assumptions that forms part of our lives and that is transferred unconsciously to other individuals during interactions. Thus, gender becomes a segment of the teaching and learning process in STEM where women do not feel comfortable in the classroom to speak out or to participate in class discussions and they are often less successful in examinations than their male peers.

It is therefore important to make academic teaching staff aware of the importance of knowing the views of students on their teaching for improvement. Some studies have pointed to the need for academic teaching staff to cater for gender inclusivity in their teaching process (Blair, Miller, Ong & Zastavker, 2017). Gender inclusivity includes continuous attention to the teaching and learning process by ensuring circumstances where no student is felt being left out or different (Mills, Ayre & Gill, 2008). Gender inclusivity in engineering majors must be integrated as part of a continuous process instead of a one-off process.

According to Thanacoody, Bartram, Barker and Jacobs (2006, p. 539), one main hindrance to the career progression of female academic teaching staff is associated with gender stereotypes even when evidence has shown that academics are doing well as leaders. Johnson (2000) has stated that women are equal to men in terms of innovation, charm and creativity. Cleveland, Stockdale, Murphy and Gutek (2000, pp. 42-43) argue that gender stereotypes are beliefs about the qualities attributed to men and women and these influence the opinion of individuals about men and women. The succession of women in senior academic roles depends on workplace strategies and cultures (Kubuabola, Rich & Shah, 2016, p. 78). This is more effective when women hold positions of power that were initially earmarked for men only in the engineering field. This was shown in the study of Wilson and King (2016, p. 190), which showed that black working-class women who are in positions of power are role models for other women. Although it is known that engineering has been conventionally a male field, in recent years the number of women is increasing gradually in the engineering field in the public universities in Mauritius.

#### **3.3.3.3 Achieving good grades**

Another issue, which emerges in the literature, concerns the negative role that grades play in deterring women from pursuing an engineering career. Seymour's (1995) studies on female and male engineering students in America, for instance, showed that the female students did not continue with the engineering programme compared to their male counterparts when their grades were poor. Seymour's (1995) study showed that, predominantly, only women who perform well persist in tough fields like engineering. Therefore, female students who choose the male-dominated fields like engineering may consider themselves as swimming against the stream to prove that they can succeed in STEM as well. For example, female students may challenge their minority status by achieving high grades (Sonnert & Fox, 2012, pp. 76-77). Female students do well in class when they represent at least around one fifth of the total number of students in class, otherwise the possibility of dropping out is higher (Mills, Ayre & Gill, 2008, p. 8). According to a study conducted in Malaysia, it was found that the presence of women in undergraduate programmes is promising whereas in postgraduate programmes and in the labour market, more effort should be done to encourage women (Goy et al., 2018, p. 14). However, female students may only want to be motivated by other female students in their field of study.

The participation and performance of students in undergraduate education in the engineering field are important aspects in the study of gender and higher education. Therefore, the gender and performance of female engineering students are somehow related to the learning experiences of the students. Due to the existence of favouritism towards men in the culture of STEM, literature has shown the various means in which women's experiences can be improved in STEM. Cheryan, Ziegler, Montoya and Jiang (2016, p. 6) conceptualised masculine culture as description of a field that can make women feel inferior to men in terms of achievement in STEM. Hence, positive reinforcement and stressing that the educational performance of male and female students is similar and equal, is the best way to encourage everyone (Thurairaja, Amaratunga & Haigh, 2007, p. 8). A good performance may mean a high probability of retention and a bad performance may mean a high probability of attrition. Therefore, a good performance may improve the presence of female students in the engineering field, which may emanate from good learning experiences.

Another theme that emerges in the literature concerns the role that parental positive affirmation and promotion of gender equality play in improving self-esteem and performance of women in STEM subjects. According to Laskowski (2006) cited in Thurairaja, Amaratunga and Haigh (2007, p. 8), the positive strengthening that there is no difference between men and women, is imperative to increase the confidence and the possibility of success for young women. When young women are made to believe that men are more intelligent than women, these young women may start to consider this as the truth and may find it impossible to compete with men (Ambady, Shih, Kim & Pittinsky, 2001; Miller, Eagly & Linn, 2015; Eccles, 2015, p. 131). Furthermore, a guarantee to equal opportunities may redress the situation by encouraging more women to enter STEM and by retaining more women in the field. Parents are social agents who allocate the messages of the culture to young women (Bamberger, 2014). Women's interests in STEM fields are strengthened when they receive support from parents for "cross-gender-typed domains" (Leaper, Farkas & Brown, 2012, p. 270). Many parents whose children are in STEM, are found to be directive and encouraging (Sadler, Sonnert, Hazari & Tai, 2014, p. 3). The literature

has shown that parents can encourage young women in STEM and they have a vital role in developing and increasing the interests of women in STEM.

#### **3.3.3.4 Innovative teaching**

In Mauritius, the traditional teacher-centred approach continues to be the dominant teaching process in primary and secondary education and there is a need for innovative and technological teaching and learning approaches in the education system, from primary education to higher education. Connell (1996, p. 206) states that masculinising performances are focused on some locations: curriculum, discipline and sports. Such practices constitute the gender regimes of an institution and these influence the learning experiences of female students, including engineering students at a higher education institution. In an applied area like engineering, Mills, Ayre and Gill (2008, p. 2), describe an inclusive curriculum as one that will consider the practice of engineering in everyday life by considering gender, race, culture and class. Research has shown that an inclusive curriculum enriches the engagement, retention and success of students (Kramer-Koehler et al., 1995; Fromm, 2003 cited in Mills et al., 2009, p. 1). “An important component that international literature covers, relates to the impact of curricular and instructional methodologies on female students” (Schultz, 2011, p. 90). Mills and Ayre (2003) mention the appropriateness of arranging the curriculum of engineering to identify students from different profiles and backgrounds. This is reinforced by Sagebiel (2003), who also proposes an upgraded curriculum would make both the climate and content of teaching attractive to students (Thurairajah, Amaratunga & Haigh, 2007, p. 8). The curriculum content and relevance of specific modules may lead to undesirable views of the amount and strength of work involved in engineering, thus discouraging the female students to engage in engineering.

Du and Kolmos (2007, 2009) state that pedagogies such as problem-based learning can improve the presence of women in engineering courses and that according to Marra, Rodgers, Shen and Bogue (2012) and according to Kokkelenberg and Sinha (2010), these pedagogies may help educators to address some of the reasons women mention for avoiding STEM subjects. Some authors suggest that female students evade technical subjects such as STEM, which they perceive as overly theoretical, non-experiential, or lacking hands-on activity (Kelly, 2007; Richter & Grottko,

2007). Engineering curricula that include problem-based learning may hold greater attraction for female students. Overall, female students were more at ease in collaborative teaching and learning techniques (Du & Kolmos, 2009, p. 433). The importance of taking an industrial placement is fruitful because it gives an opportunity to women to demonstrate that they are as intelligent as men (Burke & Mattis, 2007, p. 59). Students indicated that, through group work, they developed better ways to collaborate and that they frequently received support from peers. Students described group work as a means “to keep women who had a strong wish to study engineering from dropping out” (Du & Kolmos, 2009, p. 433). Literature also suggests that more project work, teamwork and industrial placement in engineering curricula, may strengthen the interests of female students (Watermeyer, 2012). Powell and Snellman (2004) state that teaching and assessment resources that are conversant and applicable to women could be integrated in the curriculum. To attract more women to STEM, an inclusive curriculum should be gender inclusive and culturally inclusive (Mills, Ayre & Gill, 2011). An inclusive curriculum is important because students perform well in their studies when their culture is mirrored in the classroom (Mujawamariya & Hamdan, 2013). The engineering curriculum is written in a way that favours men (Persson, 2019). This suggests that the engineering curriculum in higher education has been designed in favour of men, thus a disadvantage for women.

The most imperative concern of STEM is to recruit and retain women in higher education and in employment (Thurairajah, Amaratunga & Haigh, 2007, p. 9; Diekman, Clark, Johnston, Brown & Steinberg, 2011). Women are considerably under-represented in STEM, which requires further recruitment work to overcome industry perceptions (Leonard, 2018, p. 2). The retention and pass-rate of women in STEM differs according to the specific field (White & Massiha, 2016, p. 2). As a result, a comprehensive approach will not only improve the advancement of women socially and culturally, but it will also decrease the stereotyped beliefs of students towards engineering programmes.

### **3.4 Section 2: Female engineering students in higher education**

#### **3.4.1 School type and attitudes towards STEM**

Another theme that has been emerging in the literature concerns the role that school type plays in shaping women's attitudes towards STEM subjects. When female and male students attend a co-education school, their gendered beliefs on roles and attitudes become stronger and they have the tendency to follow gender roles more powerfully (Küskü, Özbilgin & Özkale, 2007). Some studies indicate that women develop a higher degree of self-confidence in male-dominated subjects when they are in single-sex classrooms or classrooms with a higher share of female students (Schneeweis & Zweimüller, 2009, p. 4; Kessels & Hannover, 2008). From a study conducted in a girls' single-sex high school in USA, the results indicated that the school had a major role in increasing the students' interest, confidence and sense of community in pursuing technology related careers (Mehta et al., 2018, p. 375). This shows that single-sex classrooms/schools may increase the confidence level of female students in STEM.

Heemskerk, ten Dam, Volman and Admiraal (2009, p. 254) argue that, although both male and female students seemed to benefit from educational tools, gender disparities exist in the approaches of female and male students towards the use of educational tools and towards learning and that female students using less inclusive engineering tools (heavy and rough) found it difficult to adapt themselves in the classrooms compared to the male students (Heemskerk, ten Dam, Volman & Admiraal, 2009, p. 254). However, female students were more comfortable with more inclusive engineering tools (light, soft and smooth) (Heemskerk, ten Dam, Volman & Admiraal, 2009, p. 254), because they have been made to believe that they are more at ease with such engineering tools. Instead of encouraging women to use all types of engineering tools, cultural gendered beliefs only hinder the greater involvement of women in STEM. In contrast to the study of Heemskerk, ten Dam, Volman and Admiraal, a study conducted with women in the military revealed "women should be in the military not because they are like men but because they can alter the masculine culture" (Sasson-Levy, 2003, p. 443).

Single-sex schools erase gender stereotypes (Law & Sikora, 2020, p. 1). Single-sex schools are considered to stabilise gender stereotypes that harmfully affect women's

engagement in STEM (Forgasz & Leder, 2019). “The social class, the gender identity, racial identity and the religious ethos all play a role in defining the culture of the school and the experiences of the students and teachers in it” (O’Gorman, 2018, p. 9). According to Koekemoer (2018, p. 21), girls attending single-sex education have the tendency to be more competitive, less shy, and take greater risks in a single-gender setting. Dustmann and Ku (2018, p. 32) have argued that, in their study, they found strong evidence that students who attended single-sex schools did better in assessment than students in co-educational schools. According to Hahn and Wang (2019, p. 1), worldwide there is an increasing awareness in exploiting single-sex schools to increase student achievement. When related to other types of schools, single-sex female schools have a strong examination and academic achievement culture (O’Gorman, 2018, p. 9). The performance and achievement of female students in STEM confirmed the effectiveness of single-sex schools (Franklin, 2019, p. 81). Single-sex schools are believed to encourage women’s achievement and engagement in STEM.

### **3.4.2 Learning experiences of female engineering students in higher education institutions**

Dewey (as cited in Glassman, 2001, p. 8) perceives experience as a physical act and as the consequences of that act. Dewey dislikes the contradiction that arises between the act of an individual and the way the individual thinks about the act. According to Dewey, these two aspects cannot be considered separately. Dewey highlights that experience plays a vital role in education, which includes the student and the educational environment. For example, a student who engages in rote learning does not hold any educational value whereas a worthwhile experience is an activity in which action and consequence are connected to previous and future activities. According to Dewey (1912), education is the factor that establishes improvement. It is a strength that assists students in creating their primary experiences, leading to the secondary experiences of investigation and the organisation of knowledge (Dewey, 1912). The way teachers create experiences is inevitably an expression of their gender relationships with students. The dimensions of experience that are practical, intellectual and emotional are to be studied together (Roth & Jornet, 2014, p. 122). In the same way, gender relations between students and academic teaching staff existing in higher education institutions influence the experiences of female

engineering students. As this study is interested in understanding how the gender regimes shape the learning experiences of female engineering students at a higher education institution, it is important to know that learning experiences are often influenced by interests, confidence, peer interactions and interactions with teachers inside as well as outside the classrooms (Bachman, Hebl, Martinez & Rittmayer, 2009, p. 2). All these four aspects mentioned were of interest as I embarked on this study.

According to a study in New Zealand, the process of learning involves not only obtaining knowledge of a topic but also engaging with cultural access and integration within communities of practice (Stonyer, 2002, p. 392). In the engineering field, women experience a dominant engineering discourse, gendered power relations and the assumptions inherent in feminist discourses (Stonyer, 2002, p. 397). In their study, Banerjee, Schenke, Lam and Eccles (2018, p. 300) state that the experiences of primary education had altered the self-beliefs of female students about specific fields of study such as engineering, which subsequently moulded their attitudes. Early influences can therefore shape the field of study female students may choose in higher education. Studying a STEM field in higher education is, therefore, dependent on primary and secondary education.

Furthermore, the intellectual, emotional and belief dissimilarities amongst individuals may be associated with biological developments such as changes in size and shape of the body and the experiences in wider socio-cultural contexts of everyone (Wang & Degol, 2013). Biological changes and cultural processes influence an individual. Many female students in STEM fields mentioned experiences with discrimination and prejudice thus making it hard for them to stay in the field (Smith & Gayles, 2018, p. 4). Favouritism and difference in treatment by staff also weaken the positive experience because academic teaching staff were found to be more supportive of male students (Milkman, Akinola & Chugh, 2015). Women's learning experiences are highly influenced by all the factors mentioned above.

### 3.5 Section 3: Gender context in Mauritius

This section reports on the gender context in Mauritius and includes the changes related to education that have taken place before and after independence in Mauritius. A major improvement in the constitution of Mauritius occurred in 1948 when there were the first general elections in which women had the right to vote. In 1968, after the independence of Mauritius, there were significant changes in the education system with funding and infrastructural development from the new Government. After independence, the education system was given major importance to overcome the requirements of a fast-developing country. Free education, which was provided to children in primary education, was also extended to students in secondary education in 1977 and in 1988 to students in higher education (full time undergraduate degree enrolled in a public local university). The focus to provide education to all was also related to the fact that the Government of Mauritius wanted to achieve full employment. To increase the presence of women in the labour market, it was necessary for the country to expand its education sector. Such development resulted in an increase in the number of students in secondary schools and in higher education.

Gender equality is a main concern and a crucial component of human development. In Mauritius, the “government has been focusing on rebalancing growth, boosting productivity, consolidating social development and social justice and promoting environmental protection” (Arouri, Boubaker & Nguyen, 2013, p. 116). Mauritius carried out a thorough review of its laws regarding gender equality and women’s empowerment to protect and promote women’s rights. Mauritius has approved many international human rights arrangements (Tandrayen-Ragoobur & Gokulsing, 2013). Although there is no gender disparity generally in education in Mauritius, statistics have shown that STEM remains a field in which men surpasses women even if, as Naugah, Reiss and Watts (2019, p. 24) have indicated, parents maintain that their daughters are given the freedom to choose their subjects and eventually their career, as they were confident about the intellectual ability of their daughters. For instance, in educational institutions globally, female students in STEM are taught mainly by male teachers, as is the case in Mauritius. Therefore, STEM is still considered as a masculine field. Due to the dearth of women in STEM, female students have no role

models for support, encouragement and motivation. This disparity in the number of academic teaching staff has an influence on the self-selection process of a specific field of study and may then lead to attrition – the students drop out of the chosen major in engineering. Although Mauritius has put a lot of emphasis in the advancement of women, gender equality seems to fade (Bunwaree, 2014, p. 585). Indeed, in Mauritius, the gender division of labour within the family means that, as women join employment, they often continue to be accountable for caregiving (Blin, 2008, p. 5). Despite the effort being made by the Government of Mauritius in terms of laws to accommodate more women in various fields, the culture that exists in Mauritius still makes women hesitate to join and persist in the STEM field.

In this study, gender regimes constitute the gender relations that exist between the male and female engineering students, and the teaching staff (male and female) and the female engineering students. Mainly, the focus was on understanding how these gender relations shape the type of learning experiences that female students have in engineering classrooms in a higher education institution. As this study is interested in understanding how the gender regimes relate to the learning experiences of female engineering students at a higher education institution, it is important to also explore the types of learning experiences that female students pursuing engineering have in higher education institutions.

### **3.6 Chapter summary**

This chapter started by problematising the STEM field. The chapter provided an insight into those women who have chosen engineering as a field of study and as a career. The chapter considered the long-researched relationship between STEM and women and showed how gender and the low participation of women in STEM are intertwined. Adopting a career in the STEM field by women and the progress of women in developing countries in STEM were discussed from a feminist perspective. The chapter provides an insight into those women who have chosen engineering as a field of study and as a career. It was mentioned that female students in the engineering field perceived that engineering is an important way to enhance the society and women engineers contend that the only thing that matters is their ability (and not their gender) to do the job well. It emerged that the low participation of women in STEM is shaped by different factors, namely the relatively minimal

presence of women as academic teaching staff, the feminine characteristics of female students, difficulties in attainment of good grades in STEM and teaching methods. It was noted that there is a dearth of female academic teaching staff in STEM, which might prevent the female students from joining STEM. Further, the feminine characteristics of female students were also a disadvantage to female students, and thus the female students tried to portray a degree of masculinity that was much more appreciated by their male peers. Retention was also one of the aspects, that was discussed in the chapter. Attaining good grades in STEM subjects was tough and harsh for many female students. The chapter then covered women who are engaged in STEM and why they made such a choice of field. Further, there was discussion of the learning experiences of female students while studying the engineering field in higher education. Gender inclusivity amongst academic teaching staff in the engineering field was discussed, which increased the interest and retention of female students in the engineering classroom.

The next chapter elaborates on and discusses the research methodology. It provides a detailed account of the processes in which I engaged to generate and analyse the data.

## **CHAPTER 4: DESIGNING THE CASE STUDY: REACHING THE VOICES OF FEMALE ENGINEERING STUDENTS**

### **4.1 Introduction**

As stated in chapter 1, the goal of the study was to generate understanding on the existing gender regimes in a higher education institution, how these gender regimes shape the learning experiences of female engineering students and also why gender regimes influence the learning experiences of female engineering students at a higher education institution in the way they do. To shed light on the study, it was essential to study the context - a gendered institution that provided the interactive and relational set up, students and academic teaching staff. This study further explores the gendered beliefs, roles of academic teaching staff, male peers and culture of engineering from a feminist perspective. In exploring gender regimes in the selected higher education institution, the study utilised qualitative questionnaires, focus group discussions, critical individual conversations and documents. I was able to highlight and unpack the experiences of female engineering students in the higher education institution.

### **4.2 Structure of the chapter**

The present chapter sets out the map adopted while undertaking the study. It comprises four sections in which details pertaining to the methodological design of this study are spelt out. It also brings out the difficulties and challenges I encountered during the research and the decisions I eventually took. The basis of these decisions is also discussed. Before engaging in the fieldwork, a pilot study was conducted, which is also discussed in this chapter.

Section 1 comprises the methodological layout adopted for this study. Within this section, the use of a qualitative case study approach located in the feminist paradigm is elaborated. The decision to engage in a case study research as research methodology is explained with reference to insights brought about by the literature. The sampling procedures and criteria used for the selection of the participants are provided.

Section 2 explains the steps taken to start the study, as well as the procedure associated with access to the higher education institution and returning to the field after one year. This section justifies the choice and design of instruments for data production, and each data production method is detailed. To ensure the thickness and quality of data, the process of building a rapport with the participants is also explained.

Section 3 describes actions put in place by the researcher to ensure the quality of the study. An outline of the credibility, dependability, confirmability, pilot study, positionality, ethical considerations and delimitations of the study is presented.

Section 4 provides details on the process of data analysis used in this study.

### **4.3 Section 1: Qualitative case study design**

#### **4.3.1 Qualitative research**

Researchers doing qualitative research focus on the way individuals give meanings to things in their lives (Taylor, Bogdan & DeVault, 2015, pp. 7-8). Qualitative research uses data that has occurred naturally to understand how and what meanings are adopted (Silverman, 2014, p. 18). After answering the ‘what’ and the ‘how’ questions, the ‘why’ question was answered by assessing the broader contexts in which the phenomenon rises (Silverman, 2014, p. 18). As the focus of the study was on accessing gender regimes through the learning experiences of female engineering students, qualitative research enabled me as a researcher to study the selected phenomenon by delving deeply into the data (Hagen, 1992). Qualitative research may address social problems most effectively by influencing practitioner practice, through the provision of rich descriptions of everyday practice (Silverman, 2016, p. 26). Qualitative research was thus deemed most suitable to obtain the experiences of female engineering students.

The qualitative methodological approach used in this study constituted a relatively innovative view on the question in the local Mauritian context. The case study approach opened space for a different perspective to understand how female students pursuing engineering as an undergraduate major relate their learning experiences to the gender regimes that exist within the institution other than solely on gender roles,

beliefs and stereotypes. Gender regimes, which are an assemblage of gender relations within a specific context, were explored. The case study approach in the study served to offer a holistic perspective of the influences of gender regimes on the learning experiences of female engineering students.

#### **4.3.2 Feminist paradigm**

A research paradigm focuses on the theoretical components of social sciences (Wahyuni, 2012, p. 67). Willis, Jost and Nilakanta (2007, p. 8) describe a paradigm as a thorough system that directs the investigation. From a theoretical understanding, a paradigm consists of an opinion on the nature of reality (ontology) – “whether it is internal or external to the knower”; an opinion of the type of knowledge that can be produced and standards for justifying it (epistemology); and a well-organised method to produce that knowledge (methodology) (Taylor & Medina, 2011, p. 2). Epistemology is closely related to ontology and methodology; as ontology entails the philosophy of reality, epistemology focuses on how we come to know that reality, while methodology recognises the practices used to attain knowledge of it (Krauss, 2005, pp. 758-759). Amongst the different types of research paradigms, namely positivist, interpretivist, structuralist, feminist and poststructuralist, I position myself in the feminist paradigm because, according to Ardovini-Brooker (2002, p. 9), the objective of feminist research is to discover and eradicate the blinders that conceal knowledge and interpretations with regard to women’s experiences and behaviours that have conventionally been suppressed. The feminist paradigm enabled me to draw upon the insights of women, by placing them in the middle of the research inquiry and by raising the concerns around power.

In feminist epistemology, the diversity of women’s voices is fundamental (Durna, 1991, p. xiii). According to Flick (2018, pp. 67-68), feminist research usually makes use of qualitative research to reach out to women’s voices, instead of quantitative research, which often cannot capture the voices of women. A feminist perspective permits the voices of women to be heard and a qualitative research approach makes sure that the most important voices of the participants explore the value and quality of data.

Feminist research encompasses gender equality in economic, social and political arenas (Imam, Rahim & Raza, 2018, p. 2). Feminist perspectives carry messages of empowerment that verify knowledge claims by those who have privileged positions. Feminist theory and tradition involve taking steps to eliminate privileges given to a specific group (Hesse-Biber, 2011, p. 3). Gender regimes operating in a higher education institution can be studied through the feminist lens that enables the study of the complexity of a gendered context, which no other paradigm can do.

Feminist perspectives are viewed as problematising the different conditions of women and the settings that create such conditions (Cresswell, 2014, p. 98). In many contexts, gender regimes conceal the oppression that women usually experience. For instance, educational and institutional contexts work towards covering up such inequalities through a politically correct discourse. Thus, in researching such contexts, individuals are interviewed to know how they have personally experienced discrimination (Cresswell, 2014, p. 48). For this study, a concern associated with discrimination of individuals was examined. This calls for a methodology that allows for the exposure of complexity of structures and for interactions to emerge. It is understood that through narrative interviews, personal experiences are told and constructed in ways that allow emotions to unveil (Hutchinson, Wilson & Wilson, 1994, p. 162).

Feminist research has enabled to explore how gender regimes operate through personal, institutional, cultural, curricular and emotional experiences, which all form part of the learning experiences of the female engineering students. The meaning that the female engineering students ascribed to their learning experiences was explored with reference to those meanings influencing their learning experiences.

#### **4.3.2.1 Epistemological stance**

Epistemology presents the following questions: “What is the relationship between the knower and what is known? How do we know what we know? What counts as knowledge?” (Krauss, 2005, pp. 758-759). An epistemology is a concept about what knowledge is, how is knowledge acquired and who can acquire knowledge (Raven, 2014, p. 244). According to Alcoff and Potter (1993, p. 1), feminist theorists refer to feminist epistemology as the ways of knowing of women, the experiences of women

or knowledge of women. Ardovini-Brooker (2002, p. 1) summarised the term “feminist epistemology” as combining the knowledge of women with their experiences. According to Ardovini-Brooker (2002, p. 2), feminist researchers do not have to look “for the one truth but for the multiple truths” that exist in the discrimination of women. Feminist epistemology is used to significantly assess the structure of male knowledge (Dillard, 2000). According to Harding (1987), in feminist epistemology, the issue of gender is a key aspect, especially in terms of identifying the knower and the experiential aspects of knowing. Feminist epistemology is a philosophy that allows researchers to analyse and understand the experiences of oppressed women and to apply this knowledge for social change (Nagy Hesse-Biber & Leavy, 2006, p. 56). Thus, feminist epistemology identifies how dominant conceptions and practices disadvantage women and the struggles they undertake to reform them to serve their interests.

From a feminist perspective, feminist epistemology is well matched with intersectionality, as knowledge, knower and knowing are associated with power and discrimination (Else-Quest & Hyde, 2016, p. 160). The social structure of institutional settings has an influence on how individuals experience the world (Hartsock, 1987, p. 188). According to Raven (2014, p. 247), feminist epistemologists can change the view that knowledge is male. Therefore, studying the inclusion of women in the STEM fields aims to address the absence of women in STEM fields, thereby also changing knowledge construction around engineering, which, in the context of Mauritius, has often been construed in masculine terms.

This could not be achieved with epistemological assumptions characteristic of those drawn upon when observing teaching and learning in classroom. Instead, more engaged critical individual conversations were required. Knowledge of what participants said depended on the knowledge of the background of beliefs, values and practices of the context (higher education institution) that altogether created a gender regime within the context. My interpretation of the participants’ discourse assumed that forms of oppression might covertly or overtly operate in ways that consciously or unconsciously affect the way they experienced learning, being and becoming. This epistemological position linked up effectively with the feminist research paradigm within which this study situates itself.

Furthermore, interaction with the participants allowed me to make meaning of their experiences. It took the epistemological stance that the procedure of meaning making of the learning experiences of the participants from their critical individual conversations is the fundamentals for generating new knowledge. Critical individual conversations were reflective in nature, which drew on the notion of power and dominance and reciprocity between the researcher and the participants. During the critical individual conversations, both the researcher and the participants were able to make meaning of whatever was said by the participants. The participants were actively involved in meaning making with the researcher and the researcher had the power of making meaning by probing.

#### **4.3.2.2 Ontological stance**

According to Dall’Alba (2009, p. 35), ontology is “being in-the-world”, which emphasises that people are rooted in and entangled with their world. In this way, ontology, or what it means to be an individual in a specific role, is a precursor and is an essential part of identity advancement, or of how a person positions himself/herself and is positioned by others in that role (Verdín, Godwin & Ross, 2018, p. 34). Blaikie (2000, p. 8) describes “ontology as claims and assumptions that are made about the nature of social reality, claims about what exists, what it looks like, what units make it up and how these units interact with each other”.

Based on the ontological stance that there is not only one reality, but as multiple realities also exist, the study situates itself within a feminist paradigm (Feldman, 2018, p. 2; Nold, 2018, p. 60). As the choice of any paradigm is bound to rest on its fitness for purpose, the feminist paradigm here is deemed to be an effective means of exploring gender regimes and learning experiences, as it includes the presence or absence of discourse of written or oral words, practices and actions, experiences and relations of power that finally altogether lead to multiple truths. The feminist paradigm informs that individuals make meanings and interpretations from their experiences. From this paradigmatic awareness, to gain knowledge of the experiences of the participants, the choice of methodology became critical, as I wanted a methodology that would enable me to study the lived experiences of the female students pursuing engineering in the selected institution. I wanted a

methodology that would enable me to study power structures and systems, by allowing the women to narrate their stories; something critical for feminist research.

#### 4.3.3 Case study methodology

A qualitative research design, which included a case study approach, was used to explore the learning experiences of female engineering students. Case study is an in-depth exploration from numerous viewpoints of the complications and exclusivity of a specific context (Simons, 2009, p. 21). In this study, the higher education institution selected represents the ‘case’ (Yin, 2002) under study.

Case study methodology allows a researcher to thoroughly study the findings of a specific context at micro level. In nearly all instances, a case study methodology selects a small geographical area or a limited number of individuals as the subjects of study are studied in detail. “Case studies, in their true essence, explore and investigate contemporary real-life phenomenon through detailed contextual analysis of a limited number of events or conditions, and their relationships” (Zainal, 2007, pp. 1-2). Yin (2003, p. 13) defines a case as “a contemporary phenomenon within its real-life context, especially when the boundaries between a phenomenon and context are not clear and the researcher has little control over the phenomenon and context”. In this study, the link between phenomenon and context is critical because the context (higher education institution) shapes the learning experiences of the phenomenon (female engineering student). In many case studies, an in-depth longitudinal analysis of a single case or event is used. For instance, studies on experiences of female students can be performed using this longitudinal case study method. In this study, the female engineering students were the drivers of their narrative and usually one takes time to listen to the narratives. Hence a narrative case study formed the core methodological approach of the study. Cohen, Manion and Morrison (2007, p. 170) define a “case study as an ‘investigation into a specific instance or phenomenon in its real-life context’”. This study was conducted on a small-scale and in a narrow research context, namely: a higher education institution.

According to Creswell (2007, p. 74), the various types of case studies may be differentiated by the size of the case – single individual or multiple individuals. Creswell (2007) also identifies and discusses three types of case studies, namely: the

single instrumental case study, the collective or multiple case studies, and the intrinsic case study. Stake (1994, p. 291) identifies three major kinds of case studies:

- (i) “Intrinsic case studies” (studying only one female engineering student);
- (ii) “Instrumental case studies”; (examining a specific female engineering student to gain insights into gender regimes); and
- (iii) “Collective case studies” (studying groups of female engineering students to gain a broader picture of gender regimes).

Of these, the variant that I chose for the study is in line with what Creswell (2007, p. 74) refers to as the singly instrumental case study where the researcher focuses on a problem that exists and then chooses one bounded case to showcase the problem. Adding to the above insights on a case study approach, Silverman (2010) states that a bounded case is a case that has boundaries, which must be recognised at an initial stage of the research (for example, whether it included students’ behaviour if the study is in an educational context). Creswell’s (2007) and Silverman’s (2010) writings on a single instrumental case study reflect my study as it concerns only one bounded case: studying experience in a bounded higher educational space. Participants’ experiences are framed within the single bounded context.

In the study, the methodology was instrumental in enabling a universal comprehension of the complexities of the social phenomena under exploration, that is the gender regimes within a self-contained system. A case study research methodology assisted me in exploring how gender regimes within a self-contained system influence the learning experiences of female engineering students. The case study methodology “entails the detailed and intensive analysis of a single case” (Bryman, 2012, p. 66). Bryman (2012, p. 67) declares that the most popular use of the term ‘case’ links the case study with a specific location. The case in my study is firstly, the higher education institution where the research took place which was chosen because of its specificities and secondly, the main participants. Within a case study, there could be multiple cases. This framework was relevant within the context of my research because the institutional case provides the context to frame the individual experience.

#### 4.3.3.1 Selecting the ‘case’ – the higher education institution

I consulted the official list of the public and private higher education institutions in Mauritius to apprise myself of the different fields of study that each of them offers. I observed that there was only one public higher education institution that offered engineering programmes. There was no other higher education institution offering engineering programmes at that time. For ethical reasons, the real name of the higher education institution was not revealed. The Mauritian public higher education institution is thus named Fly University throughout this study. In this feminist research, I found that ‘fly’ was the appropriate word to relate to the freedom of women.

In line with Creswell (2014, p. 239), for the proposed study, I identified purposefully Fly University and the participants to enable me as a researcher to identify the problem and the research question. Fly University is the largest public university in Mauritius in terms of student enrolment, programmes offered and varied profile of academic teaching staff. It offers undergraduate and postgraduate programmes including doctoral programmes in a variety of specialities.

Fly University has been offering engineering programmes since 1976, with the first batch of students graduating in 1980. On average, the university produces some 200 engineering graduates per year. The Faculty of Engineering comprises six departments: Applied Sustainability and Enterprise Development; Chemical and Environmental Engineering; Civil Engineering; Computer Science and Engineering; Electrical and Electronic Engineering; and Mechanical and Production Engineering. The institution best fits this study, as it is a pioneer in offering engineering programmes in Mauritius.

Fly University made history in Mauritius when it appointed the first woman as Vice-Chancellor in 2013, for a period of three years. The latter became the first woman in the history of Mauritius to occupy such an important position. This shows that there has been some gradual progress at the university to encourage transformation. It is important to take note of that, in Mauritius, all recruitment, whether in public or private organisations, are based on merit. However, although the promotion systems of staff at Fly University are based on the merit principle as per Section 6 of the Act

of Fly University and on the Equal Opportunities Act 2012, men occupy all senior management positions. Of the university's Council members, only 11% are women. Although, from 2013 to 2016, the Vice-Chancellor of Fly University was a woman and recruitment and promotion are based on the Equal Opportunities Act 2012, women still represent a minority at the Council, at senior management level and in the Faculty of Engineering.

The case study methodology allowed participating female engineering students to build on their own truths in line with their lived experiences. The case study methodology drew on narrative interviewing techniques to elicit and allow voice and also provide an opportunity for the complexity of experiences to come to the fore, which primarily involved allowing women to relay their experiences through interviews during the data production process. This made sense of events and actions as told by the female participants. While I understand that case studies may not necessarily be perceived as feminist, given their focus on the "case" instead of the "narrative" as supported by feminist scholars (Latherby, 2008), I intentionally drew on the narrative interviewing technique during the interview process so as to address this shortcoming as elaborated below in the discussion on data production methods. It is important to stress that this however does not mean the adoption of narrative enquiry as my methodology. Rather, my methodology remains the case study methodology, with interviews taking the form of narratives to address the power issues and "voices" of the young women under study.

This study involved five cases of individuals within a case of an institution. The study thus draws on the strength of this double layer (one institutional and one individual) exploring how institutional forces/factors interact with personal/individual factors to produce unique experiences. While the concern was to allow for a range of experiences to emerge, I present five cases using four methods of generating data to get to the depth required in qualitative research. The expectations were to draw from the intricacies of each case. However, at an initial stage, I considered the possibility of not necessarily reporting on all cases, depending on the 'canvas' of experiences that were emerging. A case study was chosen as it yields the thickness of the explanation of context, life and education in the study that encompass the learning experiences.

#### **4.3.4 Data production methods**

In keeping with the feminist approach adopted in this study, reviewing of documents, qualitative questionnaires (Appendix 5), focus group discussions (Appendix 6) and critical individual conversations (Appendix 7) were the methods of data generation. The approach in my research was naturalistic as it was carried out in a natural setting and, as a researcher; I also personally did the data production.

##### **4.3.4.1 Using documents**

According to Bowen (2009, p. 27), document analysis is an orderly process for assessing printed and electronic documents to gain understanding and knowledge. As a research method, document analysis is mainly relevant to qualitative case studies methodology (Stake, 1995; Yin, 1994). Reports are potential sources of practical data for case studies (Mills, Bonner & Francis, 2006). Using documents, provided background information as well as historical insight into the context. According to Bowen (2009, pp. 29-30), documents can help researchers to identify the origins of specific concerns. In this study, reports on higher education, university brochure, university programme documents, university policy documents, national policy documents and legislative acts provided information on the context and helped to gain understanding of the data gained through critical individual conversations.

##### **4.3.4.2 Qualitative questionnaire**

Another method selected to generate the data was a qualitative questionnaire. It is a method of data production that uses a set of formulated questions asked to a sample of individuals in a specific sequence. One advantage linked with questionnaires (Robson, 2002) is the simplicity with which they can be processed. Questionnaires are more reliable than other methods of data production as they can, to a specific extent, produce a higher level of integrity over interviews (Gillham, 2002). The qualitative questionnaire was distributed to 12 female students (4 students each from Year 1, Year 2 and Year 4) of the four-year engineering programme in August 2017. The qualitative questionnaires were hand delivered in the respective classrooms before the start of a lecture. The civil engineering programme was chosen, based on the broad range of experiences and the future career prospects in the country that the programme offers to students, because of its curriculum, learning spaces and

assessment. Other engineering programmes may not be offering such a variety of learning experiences.

#### **4.3.4.2.1 Purpose and justification of qualitative questionnaire**

Wambui (2013, p. 5) states that feminist research often uses qualitative rather than quantitative tools. According to Taylor, Bogdan and DeVault (2015, p. 15), most feminist research builds on the ideas of social oppression and inequality. The questions that were in the qualitative questionnaire tried to unveil any type of oppression and inequality against the female engineering students. In qualitative methods, questions should be framed in terms of social processes (how it happens) and understanding the meanings underlying what people say and do (Taylor, Bogdan & DeVault, 2015, p. 43). I therefore used a qualitative questionnaire to obtain initial thoughts from the female engineering students. The purpose of the qualitative questionnaire was to provide understanding about the arrangements that exist in the learning experiences of the female students, from three different years of engineering study. This was to respond to the first and second research questions. The different dimensions of gender regimes that were explored in the qualitative questionnaire were relationships among students (both male and female students) and the curriculum. Qualitative questionnaires also explored the experiences of the female students during lectures and on the curriculum. The nature of the data obtained from the qualitative questionnaires gave a first indication of the learning experiences of the participants, which were further explored in the next two methods.

#### **4.3.4.2.2 Design of qualitative questionnaire**

The qualitative questionnaire comprised only one closed question namely Question 1. Question 1 was straightforward about the year of study in which the participant was studying. The open-ended questions were read, and appropriate themes were developed. Question 2 asked for details on what the participant enjoyed the most in doing the course. Questions 3 and 4 asked for details of the relationships amongst male and female students in the class. Question 5 asked for the participant's views on the curriculum. Question 6 asked for details about how the participant would encourage other women to enrol on the course.

#### **4.3.4.3 Focus group discussion**

A focus group is a common research method in feminist research (Wilkinson, 2011, p. 83). This methodology collects data from a small number of individuals in an informal group discussion by focusing on a topic (Wilkinson, 2011, p. 84). The discussion is usually based on a sequence of questions asked to the participants by the researcher, who acts as a mentor (Wilkinson, 2011, p. 84).

##### **4.3.4.3.1 Purpose and justification of focus group discussion**

In this study, the participants shared their learning experiences. In focus groups, researchers are able to see how the participants are responding to the questions by exchanging ideas and experiences (Liamputtong, 2011). I used focus group discussions where the participants in the group shared experiences and views related to a particular subject given to them which I supplied, giving a combined rather than an individual opinion (Cohen, Manion & Morrison, 2007, p. 376). Therefore, the participants in the focus group discussions interacted among themselves and the data surfaced from the communication and collaboration of the group. I chose focus group discussions because I wanted to have quality data from both the more vocal participants and from those who were more silent. Focus group interviews were considered to be apt, as the purpose of the research was to explore the learning experiences of women. Grouping the women together who shared these experiences provided a flowing result in considering their experiences (Bhana & Mcambi, 2013, p. 14). The purpose of the focus group discussion was to earmark the most appropriate participants for the critical individual conversation, through their interaction with other research participants and through the data they provided. It was easier for the quieter ones to speak out when they were in a group. I believe that the focus group format was a good choice for collecting information from the participants because they were more relaxed in this setting and were able to reflect on their friends' answers and even debate issues with them. The focus group discussion, which is a relatively non-hierarchical method, avoided focusing on the female students as if they were devoid of social context. This method shifted the centre of power away from the researcher towards the participants. Group discussions helped female students to shift their awareness by promoting shared commonalities. This method matches the feminist paradigm, where the researcher has less power and influence on a group than in a one to one meeting with an

individual (Wilkinson, 1998, p. 114). In focus group discussions, the participants were empowered by sharing their experiences and hearing each other's experiences too.

The focus group discussions took place during lunch break, in the campus of the higher education institution. The participants of the focus group discussions had the freedom to choose the venue of the discussions. Each of the three focus group discussions took place in a quiet place in the campus of the university. Each focus group discussion of nearly one hour, over a period of one month, took place with the participants. During the interviews, *Kreol Morisien*, the local creole, was used and each focus group discussion was audio-recorded. The focus group discussions covered areas such as relations, experiences and challenges.

#### **4.3.4.3.2 Design of the focus group discussion**

The questions of the focus group discussions were same for all the 3 groups of participants. The prepared focus group discussion questions were not adhered to in a strict fashion. Depending on the answers that were provided during the focus group discussions, sometimes the ten questions were not asked in the same order as initially planned. However, I ensured that all the ten questions were asked to all the three groups of participants for purposes of consistency. In line with the research questions of the study and the questions of the qualitative questionnaires, the questions of the focus group discussions concerned curriculum, resources, classmates and academic teaching staff. In Mauritius, the term commonly used for academic teaching staff is lecturer. The term lecturer is thus used in the questions of the focus group discussion and the programme refers to an engineering programme.

#### **4.3.4.4 Critical individual conversation**

The research interview is the mostly used data production method in qualitative research (Litchman, 2006). It can be explained as “a dialogue between the interviewer and the interviewee” to extract information from the interviewee (Bell, 2005, p. 157). Silverman (2000) notes that the main problem in interviews is to produce data that provides a reliable understanding of the experiences of individuals. Interviews allow participants to discuss their explanations of the world (Cohen, Manion & Morrison, 2000, p. 267).

#### **4.3.4.4.1 Purpose and justification of critical individual conversation**

It was intended that interview would study concepts in detail that were not covered by a questionnaire. Although interviews can be classified according to various criteria, they are most categorised by degree of structure. Cohen, Manion and Morrison (2007, p. 355) differentiate “structured interviews, unstructured interviews, non-directive interviews and focused interviews”. In this case I was not aiming to compare data gathered across the classrooms, so highly structured, standardised and quantitative interview methods were not appropriate. Thus, I interviewed students as this gave further insight and elaborated upon the responses given in the questionnaires. I used conversational interviews and more open-ended interview methods to obtain personalised, unique and nuanced information. In the critical individual conversation, questions were prepared in advance, but used as a guide only, as I decided during the interview which precise words to use and in what order, and added more prompting questions as per the responses.

Critical individual conversations, often referred to as standardised open-ended interviews (Patton, 1980, p. 219), were conducted to collect high quality narrative data. In-depth critical individual conversations were employed as a key data generation method, as these allowed for the exploration of female students’ experiences and the significance that they give to their experiences. The individual conversations were critical because they embraced emotional experiences of the participants. The conversations helped the participants to recall their experiences, which in turn yielded rich findings.

The critical individual conversation yielded rich data; all the 6 participants (although only five cases were presented) enjoyed the conversations, which enabled me to probe and explore meanings, interpretations and concerns held by participants. Lindegger (2006, p. 461) recognises the usefulness of audiotapes as a method of recording critical individual conversations as keeping audiotapes of critical individual conversations assist in overcoming the problems with validity of information. Lindegger (2006, p. 461) further mentions that case studies often use video or audiotapes to record data. In line with this understanding and with the

permission of the participants, I used an I-Pad or smart phone to audio record the critical individual conversations.

Most of the recordings of the interviews took place during lunch break, in the campus of the higher education institution. The participants chose the venue of the critical individual conversations and the venue was usually situated in an area far from other students and free from noise. The venues were appropriate and did not affect the recording of the critical individual conversations. External factors such as noise or lecturers/students walking past did not disturb the critical individual conversations and, as they progressed, the participants seemed to be at ease while they were being audio recorded. The aspect of trust was established between them and me because sometimes the critical individual conversations evolved in a conversation related to the participant's family and not related to the study at all.

I felt that it was crucial to search into the participants' views, feelings and opinions about engineering as a field to study. Additionally, the second stage of critical individual conversations enabled me to reduce the dangers to reliability and validity of the data produced from the critical individual conversations. Each critical individual conversation lasted for about one hour.

#### **4.3.4.4.2 Design of critical individual conversation**

The questions of the critical individual conversations were similar for all participants. The prepared questions of the critical individual conversations were not adhered to in a strict fashion. Depending on the answers that were provided during the critical individual conversations, sometimes the thirteen questions were not asked in the same order as written. However, I ensured that all the thirteen questions were asked to all the participants. In line with the research questions of the study, the questions of the qualitative questionnaires and the questions of the focus group discussions, the critical individual conversations concerned the curriculum, resources, classmates and academic teaching staff.

#### 4.3.5 Participants

##### 4.3.5.1 Female students on an engineering programme

At the time of this study, the four cohorts (Year 1, Year 2, Year 3 and Year 4) of an engineering programme at Fly University, had 9, 9, 14 and 7 female students respectively. These students were aged between 18 and 22 years. The distribution of male and female students is presented in Table 1.

<i>Year of Study</i>	<i>Male</i>	<i>Female</i>	<i>Total</i>
<i>Year 1</i>	23	9	32
<i>Year 2</i>	19	9	28
<i>Year 3</i>	27	14	41
<i>Year 4</i>	37	7	44

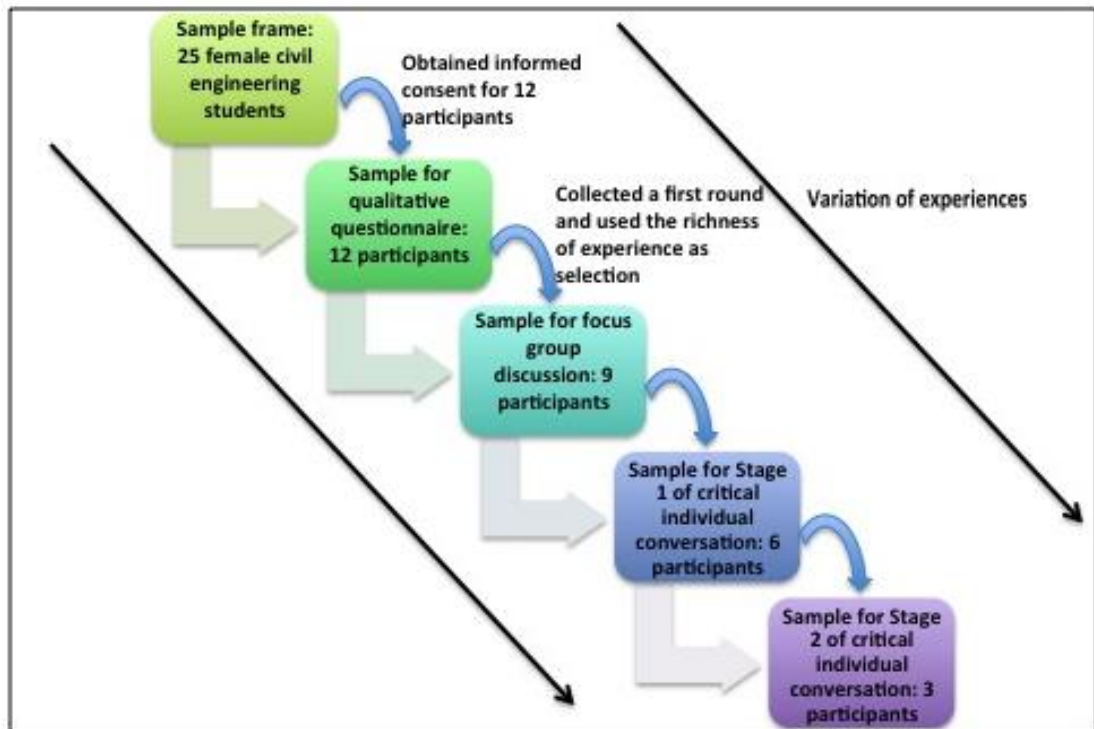
**Table 1: Distribution of students in an engineering programme at Fly University**

Although the sample of female students studying engineering was small, the sample was purposively chosen as it provided in-depth insight into the phenomenon given the diversity in the curriculum of the programme. Rubin and Rubin (1995, p. 66) offer knowledge, enthusiasm and difference as criteria to ponder “when purposively engaging in the selection of participants and participants should be knowledgeable about the cultural arena or situation or experience being studied; willing to talk; represent the range of points of view”. Moreover, I conducted at least two critical individual conversations with each participant.

##### 4.3.5.2 Selecting the participants

The next step in the fieldwork process was the selection of the participants. As there were not many female students doing engineering at the higher education institution, I chose female students from Year 1, Year 2 and Year 4 to have different learning experiences of the female students from the different years of study. The female students from Year 3 did not participate in the main study as another cohort of Year 3 female students in 2015 were participants for the pilot study. Year 3 students were chosen for the pilot study because Year 3 is the middle year in the students’ journey as an engineering student. Therefore, I refrained from selecting participants from Year 3 for the main study. Participation of the students was voluntary, and the informed consent of the participants was sought before the collection of data.

The decision for the selection of the participants and the process of selection that I used was in line with what Durrheim (2010), Kelly (2006) and Lindegger (2006) have written on the selection of participants. Durrheim (2010, p. 49) defines sampling as the selection of participants from a population, which encompasses choices about which individual, settings, and behaviours. As indicated in Table 1, there were 25 female engineering students in Year 1, Year 2 and Year 4. My sample frame comprised all the 25 female students. However, when I approached them, only a few of the female students volunteered and accepted to participate in this study. I used a variety of data production methods, which had a wide-ranging number of participants from 3 to 12. From a sample frame of 25 female engineering students, 12 students agreed to participate in the study, and they participated in the qualitative questionnaires. Based on the analysis on their response, a sample selection of 9 participants was chosen for the focus group discussions. There were three focus groups and each focus group discussion comprised 3 participants. The 3 participants from Year 1 were in the first focus group, the 3 participants from Year 2 were in the second focus group and the 3 students from Year 4 were in the third focus group. The analysis of the focus group discussions enabled me to select 6 participants for the first stage of critical individual conversations. Based on the analysis of the first stage of critical individual conversations, 3 participants for the second stage of critical individual conversations were then selected. The process of the selection of participants is shown in Figure 2.



**Figure 2: Details of sample for the three methods of data production**

The selection of participants occurred over three distinct phases, namely Phases 2, 4 and 6. As noted above, the sampling approach used in this study was “purposive sampling which explores actions and circumstances happening in the actual world” (Robson, 2002). Denzin and Lincoln (2000), Silverman (2010, p. 141) and Robson (2002), stated, “purposive sampling allows the researcher to choose a case in which she/he is interested”. The criterion that was used for purposive sampling, was the year of study of the students who had a variation of experiences as follows:

- (i) 9 participants (three each from Year 1, Year 2 and Year 4) were selected from Phase 2 for the focus group discussions;
- (ii) 6 participants (two each from Year 1 and Year 2 and one from Year 4) were selected from Phase 4 for the first stage of critical individual conversations;
- (iii) 3 participants (two from Year 1 and one from Year 2) from Phase 6 were selected for the second stage of critical individual conversation that is Phase 7.

Table 2 shows a summary of the different phases of the selection of participants.

<b>Phase</b>	<b>Purpose</b>	<b>Number of Participants</b>
<b>1</b>	Distribution of qualitative questionnaire	Year 1: 4 Year 2: 4 Year 4: 4
<b>2</b>	Analysis of qualitative questionnaire by reading and re-reading each questionnaire to identify and label recurrent words, themes and concepts, to select participants for the focus group discussions	
<b>3</b>	Purposive sampling of participants for 3 focus group discussions	Year 1: 3 Year 2: 3 Year 4: 3
<b>4</b>	Analysis of focus group discussions	
<b>5</b>	Purposive sampling of participants for first stage of critical individual conversation	Year 1: 2 Year 2: 2 Year 4: 2
<b>6</b>	Analysis of critical individual conversation	
<b>7</b>	Purposive sampling of participants for second stage of critical individual conversation	Year 1: 2 Year 2: 1

**Table 2: Summary of the phases of sample selection**

Taking into consideration what Robson, Denzin, Lincoln and Silverman have outlined above, the participants for the study were selected from Year 1, Year 2 and Year 4 in 2017. At the very outset, when I first met the female students in their respective classes, I explained to them how the data production process would be. However, some female students were hesitant and were not interested in participating in the research. After discussion with identified potential participants, 12 female students voluntarily participated in the qualitative questionnaires, 4 participants from each group.

From each group of participants, 3 participants who volunteered to participate in the focus group discussion were selected. They were chosen on the basis on how they responded to the qualitative questionnaires, namely on the diversity of perspectives

they bring in terms of their experiences. 9 female students participated in the focus group discussions.

For the first stage of critical individual conversation, 6 chosen female students on whom the research focused were intentionally chosen from an engineering programme within the research site because the programme is one of the engineering fields in which fewer female students are enrolled. Purposive sampling was thus used to select the 6 participants for the critical individual conversations. The 6 main participants were chosen based on how they responded during the focus group discussion and their willingness to talk about their experiences, compared to the others. I had to do follow up conversations with 3 participants, as I still wanted to pursue some themes with them. For the second stage of critical individual conversation, 2 participants from Year 1 were promoted to Year 2 and one of the 2 participants from Year 2 was promoted to Year 3. The participants who were in Year 4 during the first stage of critical individual conversation had already graduated when the second stage of critical individual conversation was conducted after one year.

#### 4.3.5.3 Designating the participants

The distribution and designation of engineering female students who were involved in the study for each method of data production are shown in Table 3.

<i><b>Data production method</b></i>	<i><b>Number of participants</b></i>	<i><b>Codes</b></i>	<i><b>Pseudonym</b></i>
Qualitative questionnaire	12	Participant 1 Year 1	Lina
		Participant 2 Year 1	Emma
		Participant 3 Year 1	Nisha
		Participant 4 Year 1	Feroza
		Participant 5 Year 2	Annie
		Participant 6 Year 2	Isha
		Participant 7 Year 2	Salima
		Participant 8 Year 2	Olivia
		Participant 9 Year 4	Christine

		Participant 10 Year 4 Participant 11 Year 4 Participant 12 Year 4	Riya Mia Emily
Focus group discussion	9	Participant 2 Year 1 Participant 3 Year 1 Participant 4 Year 1 Participant 5 Year 2 Participant 7 Year 2 Participant 8 Year 2 Participant 10 Year 4 Participant 11 Year 4 Participant 12 Year 4	Emma Nisha Feroza Annie Salima Olivia Riya Mia Emily
First stage of critical individual conversation	6	Participant 2 Year 1 Participant 3 Year 1 Participant 7 Year 2 Participant 8 Year 2 Participant 11 Year 4 Participant 12 Year 4	Emma Nisha Salima Olivia Mia Emily
Second stage of critical individual conversation	3	Participant 2 Year 1 Participant 3 Year 1 Participant 7 Year 2	Emma Nisha Salima

**Table 3: Distribution and designation of participants**

The participants brought a variety of biographical experiences that enhanced the richness of the data.

## **4.4 Section 2: Data production**

### **4.4.1 Gaining access**

Gaining access to the research location (a higher education institution) is the first stage of fieldwork. Before the process of data production starts, an official process from the ‘gatekeeper’ is required prior to starting data production. Kelly (2006, p. 312) defines gatekeepers as people who have a say in who is let in and who is not. According to Creswell (2007, p. 71), ‘gatekeepers’ are also ‘participants’ – which he says are the ‘key informants’. In line with Creswell’s (2007) guidance, the consent of

the vice-chancellor of the public higher education institution where the fieldwork was conducted was important to allow access to the female engineering students.

Before starting the fieldwork, permission was granted on 14 October 2015 for a period of three years from the Social Science and Humanities Research Ethics Committee of the University of KwaZulu-Natal after my application for ethical clearance (Appendix 1). Getting approval for the procedure for gaining access to the higher education institution, establishing contact with the participants, and selecting them on the study were the major challenges that I had to face.

One of the requirements of the application for ethical clearance was the gatekeeper's approval letter. In an official letter, I made a formal request to the vice-chancellor of the higher education institution and explained my motivation for the study. Despite being an outsider – not someone working in that higher education institution, I did not encounter any difficulty in that process and was granted authorisation to access the participants by the vice-chancellor of the concerned higher education institution. Once ethical clearance was obtained from the Social Science and Humanities Research Ethics Committee of the University of KwaZulu-Natal, in October 2015, I embarked on the pilot study in November and December 2015. However, in 2017, I had to request a second approval from the gatekeeper for the main study as the time frame allocated earlier for the conduct of the fieldwork was over. Permission was granted without any difficulty and a copy of the timetable of the cohorts of the engineering programme was submitted so that I could plan the fieldwork. The fieldwork was conducted from August 2017 to February 2018.

#### **4.4.1.1 Informed consent**

The consent of participants means their voluntary participation in the study and the researcher should give clear instructions to participants that they can opt not to participate in the study (Creswell, 2014, p. 136). When I met the participants, I thanked them for having agreed to participate in my study. I then explained the nature and purpose of my study to them and made my expectations clear right from the start. They were assured that all information would be confidential, that they could refrain from giving information they did not feel relaxed sharing and that they could leave the study anytime. They were also told that the transcripts would be

validated by them prior to their finalisation and that, even at this point, they could choose to cut out details they did not wish to include. Once the procedure had been clarified, the participants were requested to sign the informed consent form to formalise the contract binding us. Like most consent forms for research participants, the form comprised a short explanation of the study, the importance of confidentiality and the agreement to preserve the participant's anonymity. The Informed Consent Form and the Participant Information Sheet is at Appendix 2 and Appendix 3, respectively.

#### **4.4.2 Going back to the field**

##### **4.4.2.1 Thickening of data**

In November 2018, when I presented my data to the panel members of the University of KwaZulu-Natal/Mauritius Institute of Education cohort seminar, the panel members found gaps in the data, which was too thin. More exploration and more probing were required. They thus recommended that additional fieldwork be conducted to strengthen the thickness of the data. In this regard, in January 2019, I applied for a recertification approval as the ethical clearance, which had been granted by University of KwaZulu-Natal to me in October 2015, had expired. The recertification approval was granted on 15 January 2019 for a period of one year (Appendix 4).

##### **4.4.2.2 Selecting the participants for the second stage of critical individual conversation**

Going back to the fieldwork after one year was a challenge, as I had to reconnect to the participants who fortunately agreed to continue the journey with me. The second phase of fieldwork, which was conducted between February and March 2019, comprised only critical individual conversations. For the second phase of fieldwork, I selected 3 participants from the 6 participants who were part of the critical individual conversation of the first phase of critical individual conversation. The participants were selected based on their profile and the nature of their responses in the first phase of critical individual conversation. In the first phase of critical individual conversation, there were 6 participants – two each from Year 1, Year 2 and Year 4. From the 4 participants from Year 1 and Year 2, during the second phase of fieldwork, Year 1 participants were in Year 2 and Year 2 participants were in

Year 3, while Year 4 participants had already graduated. I did not opt for qualitative questionnaires because the participants had already filled in the questionnaires during the first phase of fieldwork. Focus group discussions were also not undertaken for the second phase of fieldwork given the non-availability of the participants. Therefore, from the 6 participants who participated in the first phase of critical individual conversation, only 4 of them were still at the university for the second phase of critical individual conversation. From these 4 participants, three were chosen, based on their previous responses and of their profile as a student to have diverse and rich data. In the second phase of critical individual conversation, more probing was done regarding their previous responses as well as their evolving understanding of their own experiences.

#### **4.4.2.3 Advantage and disadvantage of re-entering the field**

During the second phase of critical individual conversation, an evolution of the learning experience was captured. An advantage of going back to the field was that the participants who were promoted to their next year of study could compare their previous year of study to the current one, thus contributing to a continuity of their learning experiences, which added a new dimension to this study. However, one major disadvantage of returning to the participants after one year was that, before probing, I had to remind them what they said during the first phase of critical individual conversation. Another disadvantage when going back to the field was that the participants of Year 4 were no longer available as they had already graduated, which was a disadvantage for this study, as the learning experiences of the final year students could not be captured.

#### **4.4.3 Establishing an enabling research relationship**

Best and Kahn (2003, p. 252) mention that the relationship of researchers with their participants is based on trust and confidence. It would be impossible to study in the feminist paradigm from a perspective that claims neutrality (Skeggs, 2005, p. 88). According to Merriam (2002, p. 6), in qualitative research, the researcher is often part of the researched world. However, being a female Mauritian adult from an Asian background, it was not difficult to become one with the participants and blend in, although I was aware that my position as both a researcher and outsider from the University could contribute to unequal power relations between the participants and

myself. Hence, I focused on establishing trust as well as maintaining informality and friendliness during my contact with the participants.

I found that establishing the desired relationship with some of the participants really challenging, because some of them would hesitate to speak about their experiences. The qualitative questionnaire, which was the very first method of data production, has also helped in establishing rapport with the participants. I hoped that by filling the questionnaire privately, they would provide a rich response. The qualitative questionnaire comprised questions, amongst others, about the curriculum, their male and female peers, and academic teaching staff. During the first meeting, the participants hesitated to answer the questions in the qualitative questionnaire because I could see them looking at each other and they were smiling. From their answers, I felt that answering the questions was difficult for them and some of them did not feel free to write about their experiences about their academic teaching staff and male peers because, for some, the answers were brief. As a researcher, the fear of talking to them and asking questions was a challenge before the conduct of the focus group discussion and the critical individual conversation, because I was not aware how they would react – shy, nervous or uncomfortable. Discomfort and nervousness of participants to speak in front of others has been recognised as a limitation of discursive methods of data production (Dawson, 2009). In line with what Morrell (2003) has stated, there is a possibility that the silence of the participants did neither suggest mistrust, nor discomfort and nervousness. It was possible that the silence of the participants suggested the power relations that existed between them and me as a government employee working in a regulatory body overseeing higher education in Mauritius. I did however try my best throughout the data generation process to reassure the participants that my interests were in their telling their stories, and that there would be no punitive action that would follow at any point during and after the study.

Initially, I was hesitant to approach the participants and to ask them about their experiences, as I did not know how they would react, as they did not even know me. They were also reluctant and shy to talk about their experiences. Moreover, they were used to more technological ways of data production, as was the case for me earlier before I engaged on this study, for example, the use of email for

questionnaires. The participants found unusual a researcher coming personally to them, because usually they fill in research questionnaires online. Fortunately, after the first month of the fieldwork, the situation and relationship between the participants and myself improved. After the collection of the qualitative questionnaires, for each group of students, I attempted to establish an enabling research relationship with my participants. In feminist research, researchers are encouraged to make participants feel comfortable by sharing experiences about their lives and this creates an atmosphere of trust and closeness with the researcher (Thwaites, 2017, pp. 3-4). According to Oakley, when a rapport is established with women, real friendships can be built (1981, p. 46). One of the principles of qualitative research is to allow reciprocity and authenticity in relationships (Thwaites, 2017, p. 3). I did so by sharing personal information about my family, my educational background and my professional background. They were happy when I talked about my experience as a student when I was doing my MSc in Computational Science and Engineering in 2005. I told them that I was the only girl in a class of 10 students and how I had to compete with the tough curriculum, sometimes the attitudes of my male peers and even sometimes of the academic teaching staff. Usually, I never discuss my personal life with others but for the sake of this study, it was important to do so. The participants were attentive and seemed to enjoy listening to all my stories, which have enabled me as a researcher to establish familiarity with them. I felt that I was considered as ‘one of their friends’ during such discussions. When considering rapport in feminist research with regard to sharing and power between interviewee and interviewer, the “feminist interview is one of equitable and honest sharing; rules of feeling, therefore, dictate genuine interest, compassion, and a desire to share openly” (Thwaites, 2017, p. 4). Thus, by trying to understand why these experiences occur, I was also transformed into a researcher with genuine interest in what the participants said.

Another method used to encourage the participants to share details of their personal experiences, critical individual conversations, was conducted with each participant. The critical individual conversation was the main method of data production. Each critical individual conversation lasted an hour in the campus of the higher education institution (usually in the yard) and the participants spoke freely about themselves, including their families, their learning experiences, their relationships with their

male and female peers and their relationship with the academic teaching staff. From the critical individual conversations, I could notice from the body language and responses that perhaps the participants were more comfortable. I also found that some of their learning experiences were like other participants and they also reminded me of my own learning experiences as a student.

#### 4.4.4 Data production process

Data production spanned over a period of nine months, namely from August 2017 to February 2018 and from February to March 2019. Minor changes were made to the initial plan of data production as I went along. Initially, the data production was planned to be conducted in 2016 but delays sometimes occurred due to unforeseen events or unavailability of the participants. In 2016, I was assigned higher responsibilities at my workplace that consumed much of my time. Overall, I was able to stick to the second plan after official approval was obtained from the gatekeeper. Table 4 shows the schedule of the data production from August 2017 to March 2019.

Method	No. of participants	Schedule
Use of documents	Not applicable	August 2017
Qualitative questionnaire	12	August 2017
Focus group discussion (3 focus group discussions each comprising 3 participants)	9	September 2017
First stage of critical individual conversations	6	October 2017 - February 2018
Second stage of critical individual conversations	3	February - March 2019

**Table 4: Schedule of the data production from August 2017 to March 2019**

The next section will elaborate on the measures taken to ensure quality of the findings.

## 4.5 Section 3: Measures to ensure quality

### 4.5.1 Trustworthiness

Trustworthiness concerns the usefulness and integrity of the findings (Cope, 2014). Trustworthiness refers to confidence in the data, understanding, and methods used to ensure the quality of a study (Polit & Beck, 2014). In every study, researchers should determine the protocols and procedures essential for a study to be considered commendable of consideration by readers (Amankwaa, 2016). Although most experts agree that trustworthiness is necessary, debates have been initiated in the literature as to what constitutes trustworthiness (Leung, 2015).

The concept of trustworthiness of case study research depends, according to Bassey (1999, p. 76, drawing on Lincoln and Guba, 1985), on:

- Prolonged engagement with data sources;
- Persistent observation of emerging issues;
- Adequate checking of data with the sources;
- Systematic testing of the emerging story against analytical statements;
- A sufficiently detailed account of the research which gives the reader confidence in the findings;
- Involvement of a critical friend; and
- An adequate audit trail in the case record.

The transcriptions of the critical individual conversations were verified by the participants before proceeding to data analysis. During data analysis, I returned several times to the transcription to make sure that the themes that were emerging were consistent with the data. Out of this list, all elements except the one concerning the involvement of a critical friend were present in this study (recognising, of course, that there are subjective judgements involved in adequate, prolonged or persistent questioning).

At the very outset, I provided clarification to the participants on my personal values, experiences and biases. I tried to avoid biases and errors that might transform the way I collect, understand and interpret the data. The questions were phrased openly and explicitly in the qualitative questionnaire and during the focus group discussion

and critical individual interview. The data captured in the three methods (qualitative questionnaire, focus group discussion and critical individual conversation), was produced in a pure and honest way as far as possible. Before engaging in fieldwork, I spent some time in the setting before the fieldwork so that the participants became familiar and comfortable with my presence and I became as “part of the furniture” during data production and some communication with the participants (Denscombe, 2005). During the first meetings, I would reach the class thirty minutes before the start of the data production through the qualitative questionnaire and before being introduced to the class by the programme coordinator or academic teaching staff. However, for the collection of data for the focus group discussion and critical individual conversation, it was easier as the participants already knew me, and they also knew what was expected from them. Credibility, dependability and confirmability are ways to confirm trustworthiness (Xerri, 2018). Moreover, the pilot study that I carried out also provided a worthy presentation to the fieldwork.

Methodological triangulation was accomplished in the present study through the production of data from four different methods (qualitative questionnaire, focus group discussion, critical individual conversation and document analysis). In traditional qualitative research, triangulation is used to suggest convergence of findings. I believe that triangulation allowed for convergence of data from various sources as well as provided rich, in-depth data that at times showed multiple versions of the same phenomenon. However, agreeing with Denzin and Lincoln (2000), I refer to triangulation in the present study not as a tool to validate claims about fundamental truths to be fixed by multiple methods, but as a process to purposive sampling to ensure the richness of the data for the critical individual conversation, which is the main method of data production. Based on the analysis of the response from the sample of students who participated in the qualitative questionnaires, a sample selection was chosen for the focus group discussions. The analysis of the focus group discussions enabled me to select the participants for the critical individual conversations.

#### **4.5.1.1 Credibility, dependability and confirmability**

Validity and reliability cannot be addressed in qualitative research as in quantitative research. The concepts of validity and reliability are fundamentally concerned with

the adequacy of measures (Bryman, 2012, p. 48). Nevertheless, qualitative researchers can incorporate measures that deal with these issues. This study used multiple methods, and trustworthiness was used instead of validity. Lincoln and Guba (1985) propose trustworthiness as a criterion for good research; this concept includes credibility, dependability and confirmability (Bryman, 2012, p. 390).

In triangulation, two or more methods of data collection are used to study the observed phenomena and it is a powerful way of establishing concurrent and respondent validity, particularly in qualitative research. Multiple sources of data aim at validating the phenomenon (Yin, 2003, p. 99) and case studies using multiple sources of evidence tend to be viewed to be of high quality. The system of triangulation can enhance the credibility, dependability and confirmability aspects of a piece of research (Denzin & Lincoln, 2000).

Different types of data production methods (qualitative questionnaire, focus group discussions, critical individual conversations and document analysis) have been used to allow me to improve the quality of the data. Through the data production phases, I followed the same processes with all the participants in the administration of the qualitative questionnaires and conduct of the focus group discussions and critical individual conversations. The same questions were used with the participants to ensure consistency throughout the study. After having transcribed the critical individual conversations, the participants had the opportunity to check the accuracy of whatever was audio recorded and transcribed. I returned to the participants by sending them a copy of the transcript by email to enable them to validate the transcript.

#### **4.5.1.1.1 Credibility**

“Credibility deals with the question: how believable are the findings?” (Bryman, 2012, p. 49) and that credibility can be achieved by the development of an early familiarity with the participants before data production takes place. Given that I work at the Higher Education Commission in Mauritius (previously Tertiary Education Commission), I am familiar with the higher education institution. The findings of the questionnaire that were administered before the focus group discussions and critical individual conversations provided contextual data that was

referred to during the critical individual conversations with participants. During the critical individual conversations, the participants were encouraged to be truthful. A positive rapport was established at the very outset and it was indicated that there is no right answer to the questions that were asked and that I wanted to capture the wholeness of their experience even if, according to them, it was irrelevant.

#### **4.5.1.1.2 Dependability**

The use of dependability in qualitative research relates to the concept of reliability in quantitative research. In qualitative research, the dependability of qualitative research can be enhanced by ensuring that complete records are kept at all phases of the research (Bryman, 2012, p. 392). This is used to examine the process and the product of the research for consistency. To ensure dependability, the processes within the study were reported in detail. During the data production phases, the same procedures with all the participants in the administration of the qualitative questionnaires and in the conduct of the focus group discussions and critical individual conversations were followed. The same questions were used as a guide with the participants to ensure consistency throughout the study. Depending on the answers received, sometimes the questions were varied slightly in response.

#### **4.5.1.1.3 Confirmability**

Confirmability is about ensuring that the researcher has “acted in good faith that is it should be apparent that he or she has not openly allowed personal values or theoretical inclinations to sway away the conduct of the research” (Bryman, 2012, p. 392). “Confirmability ensures that personal values or assessments has not had an impact on the result” (Persson, 2018, p. 17). The concept of confirmability is comparable to the qualitative researcher’s concern regarding objectivity (Abdalla, Oliveira, Azevedo & Gonzalez, 2018) and in qualitative research, the presence of the researcher’s prejudices and preconceptions is inevitable. Therefore, to be able to demonstrate the legitimacy of the data, a rapport was built with the participants to obtain quality data and establish confidence in the findings. The second stage of critical individual conversation also helped the participants to address the issues of confirmability of the data. I ensured confirmability by keeping an audit trail of the data that is, after the transcription of each critical individual conversation, I listened

to the audio-recorded conversation again to ensure that I did not miss anything in the transcription.

#### 4.5.1.2 Piloting the study

The pilot study is undertaken with individuals who possess the same characteristics as the sample (Maxwell, 2013), thus enabling the researcher to simulate the real interview in conditions as real as possible. Improvement of the interview protocol is based on the experience of the researcher when conducting the interview (Castillo-Montoya, 2016, p. 827). Merriam (2009, p. 104) pointed out that the “best way to tell whether the order of your questions works or not is to try it out in a pilot interview”. Through piloting, the researcher’s goal is to have a truthful sense of the length of the interview, whether the interview questions need improvement and any other improvement required before launching the study (Maxwell, 2013). Pilot studies may also tackle any technical problem that may arise during the interview. In line with the above, a pilot study is said to be a mini version of a full-scale study or a trial run done in preparation of the complete study or a feasibility study. One of the benefits of piloting a study is that it gives a notice about what might go wrong in the study in terms of research protocols, planned methods or instruments. To avoid taking a risk on the methodology, it is important to undertake a pilot study (Kim, 2011, p. 2).

Therefore, before beginning on this journey – the main study – I carried out a pilot study from October to December 2015 with 4 female engineering students who were enrolled in the third year of the engineering programme at the higher education institution where the main study was conducted. The purpose of the pilot study was to offer a process of preparation and experiences in data production in qualitative questionnaire, focus group discussion, critical individual conversation, note taking, audio recording and transcription. The pilot study took place to increase the quality of the data that was to be produced from the participants and identify any loopholes in the methodology used for the data production. The pilot study helped me by demonstrating any shortcomings in my methods and ensured that the data to be produced in the main study would be rich. Thus, the pilot study did not only assist in enriching the quality of the data that I intended to collect from the female engineering students for the main study but also improved the methods for the data

production, if needed. I refined the questions of the questionnaire, focus group discussion and critical individual conversation by overcoming any shortcoming in the methods, which I used to have effective results from the main study. Piloting the study had therefore enabled me to determine whether the female engineering students understood the questions. It is crucial to note that the findings of the pilot are reflected in the main study findings.

#### **4.5.1.2.1 Selecting the participants for the pilot study**

I chose the female engineering students enrolled in the third year of a four-year engineering for the pilot study because students in the third year of the programme were undergoing both theory lectures and field work and these students were quite familiar with the system existing at that particular higher education institution. The higher education institution would be the same as that of the main study. The pilot study was conducted from October to December 2015 instead of September to December 2015, because at the beginning it was quite difficult to meet the students, due to their unavailability. In October 2015, I had a meeting with all the 6 participants enrolled in the third year of the four-year engineering programme to explain to them about my research project and the methods that would be used for data production. I assured all the participants that the data that they would provide in the questionnaire, focus group discussion and critical individual conversations would be confidential and anonymous. Only 4 female students were willing to participate in the pilot study. The meeting lasted 15 minutes. The consent of the 4 female engineering students to participate in the study was obtained prior to starting the pilot study. The findings of the pilot study are at Appendix 8.

#### **4.5.1.2.2 Qualitative questionnaire in the pilot study**

The qualitative questionnaire was distributed to the 4 female engineering students in a lecture room, at the higher education institution before the start of a lecture and was collected after 30 minutes. I reassured them about confidentiality and anonymity.

#### **4.5.1.2.3 Focus group discussion in the pilot study**

In the focus group discussion, I made sure that all participants speak; some were more enthusiastic than other participants. I addressed the questions to each of them

by maintaining eye contact with each of them to provoke some reactions. The interview, which was audio recorded, lasted around one hour but the first 15 minutes were dedicated to make them comfortable so that they could talk freely. Therefore, a schedule for focus group discussion that mirrored the research questions was prepared prior to the group discussion. All the questions of the focus group discussion as a data gathering technique were quite clear to the participants. Initially, the participants were quite hesitant when answering the first question. However, when they all started participating, the flow of information improved. During the focus group discussion, I also appreciated the rapport I had with the participants – the human behaviour and interactions. As some of the participants were quite friendly with me, they did not hesitate to discuss the themes that were presented to them and they talked openly, yielding rich data.

#### **4.5.1.2.4 Critical individual conversation in the pilot study**

The critical individual conversation was conducted with one participant and lasted for one and a half hours. A participant was chosen from among the 4 participants who were in the group discussion, based on the data she provided in the focus group discussion. The schedule for critical individual conversation mirrored the research questions and was ready before the interview. The critical individual conversation was audio recorded and the participant, according to the schedule, answered the questions. This first critical individual conversation had enabled me to familiarise myself with the skills of an interviewer. After thanking the participant for having agreed to conduct the interview, I guaranteed the participant again about confidentiality and anonymity.

#### **4.5.1.2.5 Ploughing back the feedback from the pilot study into the main study**

A refining of my instruments, such as asking more ‘why’ regarding the gender issues and asking more probing questions during the focus group discussion and critical individual conversation, would enable me to have a more in-depth study of the gender regimes prevailing at Fly University. The three methods (qualitative questionnaire, focus group discussion and critical individual conversation) were retained.

Some questions of the focus group discussion were modified to make them clearer. I

added more probing questions like “Can you say more?”, “Can you explain further?”, “What exactly did you mean?”, “Could you give me an example?” and “Could you tell an incident”, to get more in-depth information.

In the critical individual conversation questions, two additional questions were included. Question 1 was added to know the type of secondary school the participants attended. This question was important because the type of secondary school (either a single-sex school or co-education school) that the participants attended had an influence on the relationship the female participants had with their male peers at Fly University. Question 9 was added to identify whether the male students interact with other female students enrolled on other programmes at the university.

#### **4.5.2 Positionality**

My work as a government employee from the regulatory body of higher education in Mauritius and having previously been a student in a programme in which I was the only girl, encouraged me to do this study. As a researcher, I knew that I was the inquirer instead of a government employee or a former student. It is generally believed that local researchers find it easier to access the study field, due to their familiarity with the local language. The local researcher is not seen as domineering and power differences between the interviewer and the interviewee are limited (Weiner-Levy & Queder, 2012, p. 1153). Being a female researcher doing research on female participants helped me to have the best possible understanding of the experiences of the young women because the culture of male supremacy, patriarchy and power were known to me, as was the case for the participants. From the outset, this positionality enabled me as a local researcher to recognise the experiences that the participants underwent. Being a woman myself, the study was important for me as I could easily find myself being in the place of the participants. Being myself previously a student from the STEM field has helped me as a researcher to understand better the learning experiences of the participants and sometimes I was also able to relate their learning experiences to my own lived experiences. It was not difficult for me to feel the discrimination/oppression that the participants experienced.

### 4.5.3 Ethical considerations

A further step prior to data production was to tackle the ethical issues during the fieldwork. Like all site-based research, the ethical issues that were considered were about consent, and about preserving the anonymity of the participants and of the higher education institution to which the participants belonged. The informed consent of each participant was also one of the ethical principles with which I strictly abided. For ethical reasons, the real names of the participants and the persons (academic teaching staff/students) mentioned in their story were not revealed, as pseudonyms were used and any information likely to reveal their identities was omitted. I must however admit that, while this was quite easily done for the participants, academic teaching staff and students, it was less easily done for the higher education institution where the research was conducted. My major responsibility as a researcher was to respect my participants' trust and protect their identity.

#### 4.5.3.1 Confidentiality

Babbie and Mouton (2009) state that qualitative social research involves deep probing into the lives of participants, and therefore, a researcher must ensure that the participants are not harmed, because they have volunteered to take part in the study and, without them, the study does not exist. There should be a concern about trust between the researcher and the participants. Therefore, although the consent letter for the study showed that the confidentiality of the participants would be protected, I felt that it was necessary in the first meeting to make it clear that there should also be confidentiality amongst the participants. As Wassenaar (2010, p. 76) highlighted, the researcher cannot guarantee that all group members will treat the information of other persons with the respect that it deserves. In this study, all the participants were encouraged to maintain confidentiality.

Even though Wassenaar (2010) proposed the inclusion of confidentiality amongst the participants in the consent form, it was not included in the consent form, which was given to the participants. This was instead discussed with the participants during the first focus group discussion that was conducted. The participants were informed about the negative consequences that could crop up if they did not keep confidentiality amongst each other, mainly regarding the information that they said

in the focus group discussion. The participants demonstrated their seriousness and responsibility towards the study about confidentiality as, after each focus group discussion and critical individual conversation, I reminded them about confidentiality. Researchers make “use of aliases or pseudonyms for individuals and places” to protect their identity (Creswell, 2014, p. 136). The identity of the higher education institution was not revealed. The real names of the participants were not on any text. In the study, pseudonyms of the participants were used to ensure the anonymity and confidentiality of the information provided by participants.

#### **4.5.3.2 Challenges of keeping anonymity in a small island state**

Guaranteeing the anonymity of the context of the research was not practical because the higher education institution is the only institution in Mauritius that offers a four-year full-time undergraduate degree in engineering. The other institutions in Mauritius offer a one-year top-up undergraduate degree in engineering. Although a pseudonym - ‘Fly University’ was given to the higher education institution where the research was conducted, it was evident that I could not guarantee anonymity of the context of the research because, in a small island state like Mauritius, people would be curious to know about the university. By adopting a feminist paradigm for the research where the voices of the participants were crucial and, from a theoretical perspective, it was important to ‘excavate’ power. There was a lot of pressure on me as a researcher to frame critiques and comments about the university in such a way so that there is no prejudice to the university.

The anonymity of participants is an essential ethical practice in social research. My aim was to reassure the participants that every effort was made that the data they provided could not be traced back. The method I adopted to preserve anonymity was the use of a pseudonym assigned to each participant. In a small island state like Mauritius, I had to accept the challenge of guaranteeing anonymity of the participants. Given that the population and sample of participants of the study were small, it was hard to guarantee the anonymity of the participants, but it was my responsibility as researcher to respect my participants’ trust and protect their identity.

As the participants were students, it was important to reassure them that whatever they would say would be anonymous and confidential. Any information likely to reveal their identities had been omitted, although in a small island like Mauritius the higher education institution is easily recognisable due to its specificity and the small size of Mauritius. Masking this without downplaying the contextual factor, which was such a significant aspect of the study, was indeed challenging.

In some cases, given the small sample size of participants, the participants knew each other and “were fully aware of who else had been interviewed” because many of the participants knew each other and were in the same class (Lancaster, 2017, p. 99). In a context of personal networks in a specific field of study where a small number of individuals were involved, I was conscious that anonymising data by using pseudonyms would not be enough to ensure anonymity (Neal & McLaughlin, 2009, p. 695). Therefore, I informally requested all the participants not to disclose any information about what was being asked to them and what they said.

#### **4.5.4 Delimitations of the study**

A limitation of the study was that it was confined to only one public higher education institution in Mauritius rather than considering other public or private higher education institutions and therefore, I was able to explore only the gender regimes that existed within that particular higher education institution. Such a study would have yielded probably different results if it would be conducted among students from other universities. Another delimitation of the study was that, to limit the sample size, the participants were only from the BEng (Hons) Civil Engineering programme, instead of being drawn also from other fields of engineering. As the study was about gender regimes, a further delimitation of the study was that the participants did not include male students, academic teaching staff or parents. This is so because, although a study in the feminist paradigm may apply to all genders, the research questions required only female students.

#### **4.6 Section 4: Data analysis**

Data analysis is the crux of the research cycle. Data produced and its analysis in qualitative research tends to be lengthy. The researcher has a crucial role in the interpretation of the data. In this section, the different phases of data analysis that I

undertook for the three methods (qualitative questionnaire, focus group discussion and the critical individual conversation) of data production are described. This stage comprised three levels as follows:

- Level 1 was devoted to the transcription of the qualitative questionnaires, focus group discussions and the critical individual conversations. “Interviews, focus group discussions and observation data all involve verbal interactions that must be transcribed and analysed” (Litosseliti, 2018, p. 118) and language concepts of transcription refer to the ‘translation’ of dialogue into writing (Litosseliti, 2018, p. 186). Prior to the transcription of the focus group discussions and the critical individual conversations, the translation from Kreol Morisien to the English language was also done at this level. The identification of themes took place, whereby the themes that had emerged to identify similarities and differences were used as the sampling principle;
- Level 2 entailed the analysis of the critical individual conversations. Cross-case analysis is typically performed to identify patterns and dissimilarities between cases (Ingram & Glod, 2016, p. 341). Cross-case analysis took place in relation to themes which emerged from the cases; and
- Research includes analysis and synthesis (Stake, 2010, p. 133). Level 3 focused on bringing together the findings obtained from Level 2 by drawing conclusions on what is lacking in the theoretical framework, which guided the whole study.

#### **4.6.1 Level 1 analysis: Analysis of qualitative questionnaires, focus group discussions and critical individual conversations**

Level 1 constituted the transcription of the qualitative questionnaires, focus group discussions and critical individual conversations, and the identification of themes. The translation of the focus group discussions and of the critical individual conversations was also done at this level. The first step of the analysis was to transcribe the data of the qualitative questionnaires followed by the translation and transcription of the focus group discussions and critical individual conversations. This process involved several steps, as the transcription process was not a mere exercise. The transcription and translation process were done immediately after each fieldwork session. According to Bamberg (2012, p. 54), data analysis starts when the

researcher embraces the reflective posture of indwelling in the recordings of interviews to immerse ourselves in the data.

#### **4.6.1.1 Translating the focus group discussions and the critical individual conversations**

The focus group discussions and critical individual conversations were conducted in Kreol Morisien, as it is the mother tongue of most Mauritians and it was easier to capture quality data in the language in which the participants were more at ease. Translation from Kreol Morisien to English was tedious work, as I had to adhere to the ‘grafi larmoni’ which is a harmonised writing system for the Mauritian Creole Language and which I am not used to. Kreol Morisien was recognised as an official language in 2004. While doing the translation in Kreol Morisien, I had to consult the dictionary for the Mauritian Kreole Morisien - Diksioner Morisien (Carpooran, 2009), to adhere to the correct grammar and writing of words. Sometimes, it was difficult to find the exact translation of some Kreol Morisien expressions that the participants used in the focus group discussions and in the critical individual conversations. In some cases, it was also challenging to find the exact matches of some expressions used by the participants, since cultural notions are not always easily conveyed to audiences who are unfamiliar with these. Some examples were “pren nissa”, “serye net”, “batiara” and “di fé”. To demonstrate an example of an expression in Kreol Morisien and its meaning in English, an extract from focus group discussion 3 with Mia is provided in Appendix 9.

#### **4.6.1.2 Transcribing the qualitative questionnaires, focus group discussions and critical individual conversations**

The transcription of the three methods of data production was therefore conducted in Microsoft Excel in three stages. Firstly, initial analysis took place to find out the main concerns and themes emerging from the data. I read all the answers to the questions in each method of data production carefully and input each answer for each question separately for each participant to get a sense of the emergent fields separately for each method of data production.

#### **4.6.1.3 Analysis of the qualitative questionnaires, focus group discussions and critical individual conversations**

The themes started to emerge from the data. I read all the answers to the questions of each data production method and input each answer for each question separately for each participant to get an idea of the transcription. I started to determine patterns, processes, commonalities, and differences. I became conversant with them, distinguished remarkable patterns, searching for the fundamental meaning and wrote the themes (which I deemed were emerging from the answers) in a column together with the raw data. Themes and main issues were pulled out from the data of each method of data production. The themes were classified for the raw data of each method of data production for each participant, which involved grouping the data into themes for analysis of specific events and ideas. These themes were not permanent as new understanding emerged during the analysis process. Themes were used not only to simplify or reduce the data but also to open and interrogate them further and formulate new questions and levels in the interpretations. I set out to discover patterns, processes, commonalities, and differences. An extract from focus group discussion 3 and Salima's critical individual conversation is provided in Appendix 10, to demonstrate the similarity between focus group discussion 3 and Salima's critical individual conversation.

I had to know from the women how they experienced their learning at university, about their relationships with academic teaching staff and peers, and with the curriculum and how these affected learning experiences. Only some parts of the data were translated from Kreol Morisien into English; the data was then analysed after translation. A thematic analysis was done by frequently going through the whole data set to be able to identify patterns of meanings. Different codes were produced whereby potential themes were recognised. Themes were further defined and refined in relation to the entire data set. Thematic analysis identified commonalities and differences in qualitative data, before concentrating on connections between them.

In the first stage of critical individual conversation, it was found that the data provided by Emily was rather thin. Her responses did not bring any new component to what other participants had said in their critical individual conversations; they were like those of the other 5 participants, namely, Emma, Nisha, Salima, Olivia and

Mia. Although the critical individual conversation was conducted with Emily, since no new component was reported in her responses, I chose not to include Emily's case in the presentation of the findings. All elements in her responses had already been captured in those of the others. Thus, the findings are presented for only 5 participants, namely, Emma, Nisha, Salima, Olivia and Mia.

#### **4.6.2 Level 2 analysis: cross-case analysis**

Cross-case analysis is a process that enables the similarities and differences in the actions, behaviours, and practices (Cruzes, Dybå, Runeson & Höst, 2015, p. 11). Level 2 analysis entailed identifying recurring themes across the cases of the second stage of critical individual conversation and themes that were unique to each case. The emergent themes were compared with the literature review. A thematic analysis was carried out through cross-case comparisons. The identification of several variables that I thought to have importance was sorted out. "In short, a reiterative process occurred within which the categorisations that permitted comparisons emerged from the cases and then used to make further comparison" (Ryan, 2012, p. 554). The researcher undertakes thematic analysis, and this involves the use of key words initially as a count (Ryan & Bernard, 2000). I classified the information systematically in a grid, inserting a column to the left where initial conclusions pertaining to each theme were encapsulated. As I engaged in an in-depth analysis of these themes in the case study of each participant, I could identify the specific conditions under which certain factors impacted on the learning experiences of the participants. This exercise allowed me to earmark similarities and differences across the cases.

There were four main themes, namely:

- (i) Male students as superior;
- (ii) Single-sex education/ co-education;
- (iii) Physique; and
- (iv) Differential treatment by academic teaching staff.

They represented important contexts in the participants' stories. The themes, which varied according to the main themes, were indicative of the specific aspects that influenced learning experience of a participant.

#### 4.6.3 Level 3 analysis

This level of analysis built on Level 2 analysis and extended to integrate the theoretical framework within the data.

#### 4.6.4 Analytical framework

Figure 3 is a diagrammatic representation of the analytical framework (Ankiah-Gangadeen, 2013, p. 63) and focuses on the principal stages of the process as I moved from the raw to refined data and thence to greater levels of abstraction.

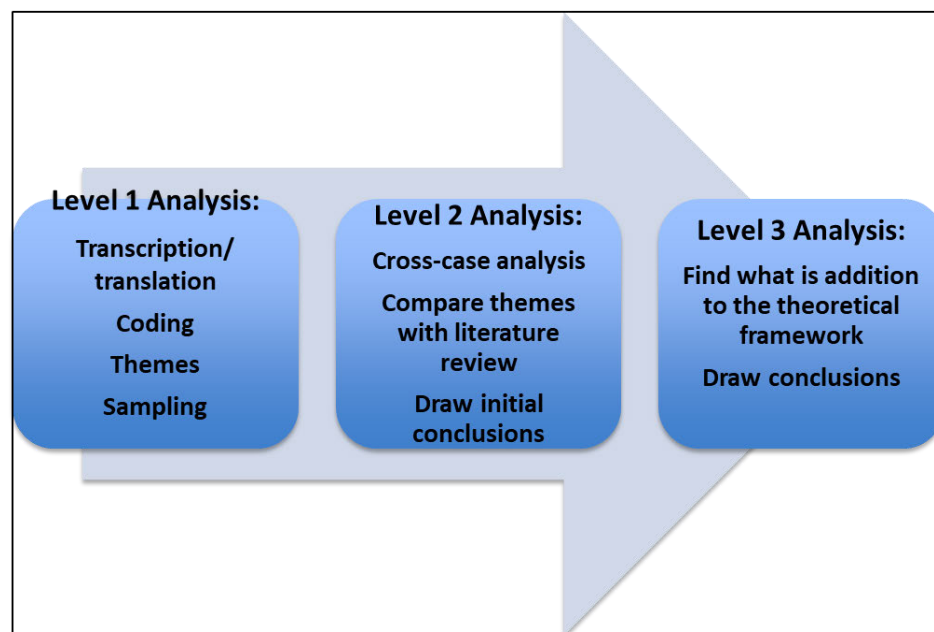


Figure 3: Analytical framework

I did my best to be alert in finding irregularities and ambiguities in relation to what other studies have found or interpreted; I had my research questions as a guiding force in the production of data for all the three methods and analysis of data for the qualitative questionnaires, focus group discussions and critical individual conversations. I classified the data in line with the research questions by keeping in mind the main concerns that this research addressed.

#### 4.7 Chapter summary

This chapter has elaborated on the research methodology. It established and justified the choice of case study as research approach and relevance of the feminist research paradigm. The decision to engage in a case study research as research methodology was explained with reference to insights brought about by the literature. It detailed the procedure for data generation, considering key considerations therein: the elaboration and implementation of tools for data production, research protocols observed and ethical considerations. The chapter also stated the delimitations of the study. It further entailed the choice and design of instruments for data production supported by literature and is justified and described. Finally, it presented the analytical framework used for this study. The next chapter presents the findings of the study.

## **CHAPTER 5: PRESENTING THE FINDINGS: LEARNING EXPERIENCES OF FEMALE ENGINEERING STUDENTS**

### **5.1 Introduction**

This chapter presents the findings of the critical individual conversations in the form of five case studies. As reported in chapter 4, the findings presented here are drawn from 5 participants, not from the original six selected. The critical individual conversations were used for each participant to obtain deeper insights into the learning experiences and gender regimes, following the qualitative questionnaires and focus group discussions. The 5 participants, with whom the critical individual conversations were held, are presented in the form of individual case studies in line with my methodology. The chapter focuses on the journey of the participants on the engineering programme, each located within a different year of study (Year 1, Year 2 and Year 4 of an engineering programme) wherein each year of study reflects on each participant's learning experience. Each critical individual conversation, which lasted for an hour, allowed the participants to discuss and express their views of being a female student in the engineering field. There were at least two meetings with each participant. Their learning experiences revealed some aspects of gender regime operating within Fly University, including the microcosm and complexity of the context. A thematic presentation of the data allowed for the richness of data to be foregrounded in line with the methodological position adopted.

### **5.2 Structure of the chapter**

This chapter comprises two sections. Section 1 gives an overview of the five cases - Emma, Nisha, Salima, Olivia and Mia. Each case gives biographic details of the participants.

Section 2 presents the themes identified through the five cases. These themes became evident through the gender discourses, and the main findings from level 1 analysis are highlighted. While each case study is special in its own way and can be studied separately, the case studies had similarities as well.

### **5.3 Section 1: Biographic details of the participants**

This section presents the five cases: Emma, Nisha, Salima, Olivia and Mia. There were two phases of critical individual conversations. Emma (Year 1), Nisha (Year 1), Salima (Year 2), Olivia (Year 2) and Mia (Year 4) were the participants for the first phase of critical individual conversations that were conducted separately for each participant. In the second phase of critical individual conversations, Emma, Nisha and Salima were the participants. In the second phase of critical individual conversations, Emma and Nisha were promoted to Year 2 whereas Salima was promoted to Year 3. The promotion to the next year of study did not impact on their interpretation of their learning experiences. On the contrary, the second phase of data production, which was conducted one year after the conduct of the first phase of data production, enriched the data and ensured the trustworthiness of data previously produced. In this section, the cases are presented in ascending order by year of study, for ease of comparison and discussion. The 5 participants were purposively chosen as the main participants, regarding their answers from the qualitative questionnaire and their participation in the focus group discussions, to allow collection of rich raw data.

Each case is presented by starting with a description of the profile of the participant; her secondary school, physical appearance of the participant and family have been included. The profile constituted these aspects that also contributed to the learning experiences of the participant around the four earmarked themes. The elements that constituted the profile were linked to the gender regimes aspect of the dimension(s) of the theoretical framework that were explained in chapter 2, such as family, belief, human relations and culture, and that guided the study. The biographical profile provided information that was related to the presentation of the data findings. The information is deliberately brief, as I engage substantively with the experiences at a later stage.

#### **5.3.1 Emma – Case 1**

Emma did her secondary schooling in a state secondary school in the northern and rural region of the island, which is one of the best single-sex secondary schools of the island. At upper secondary education – for the Cambridge School Certificate

Examinations, she studied the three science subjects (Biology, Chemistry and Physics) for two years and at Cambridge Higher School Certificate Examinations, she studied Mathematics, Chemistry and Physics for two years. Emma had always been a brilliant student during her secondary schooling and scored good grades. She belonged to a traditional Asian family and had a bold personality, wearing her traditional Indian outfit ‘salwar kameez’ with her long hair in plaits. Studying civil engineering in higher education was one of her options amongst the other engineering fields, and is the reason why she studied Mathematics, Chemistry and Physics at Cambridge Higher School Certificate Examinations. Civil engineering had been her first option whereas mechanical and electrical engineering had been her second and third options. Emma was inspired by her brother, who was an engineer. Her determination to become like her brother culminated in her confidence that she would overcome all obstacles and would become an engineer as shown below:

*“He said that companies now love to hire more female engineers because they are so few in numbers. That’s why I want to become a civil engineer like my brother who after his graduation got employed in a private firm as a trainee engineer and is now a registered civil engineer. He worked on the construction of the new airport.”*

Emma was in Year 1 of the BEng (Hons) Civil Engineering.

### 5.3.2 Nisha – Case 2

Nisha was of a small build and enjoys wearing dresses. She did her secondary schooling in an elite state secondary school in the central and urban region of the island. Her secondary school was a single-sex school and was the leading single-sex state secondary school of the island. At upper secondary education, she studied the science subjects, particularly Mathematics, Chemistry and Physics, for which she developed a passion. She came from an Asian family and lived in a rural area. Nisha had two younger brothers, who were also studying science subjects at secondary school level, and her father was an engineer. Nisha was inspired by her father and she always wanted to study engineering, which confirms the findings in the literature. To achieve gender neutrality, parents strive to foster environments in which their daughters are pushed to dream big and push limits (Bloom, 2018, p. 5). Nisha reported how her father made science interesting for her to learn when she was younger and she was also convinced that she would become a civil engineer as illustrated below:

*“Studying engineering was definitely in mind since a very young age as my father is an engineer...I fell in love with the science subjects since I was in primary school...I used to do the experiments found in the science textbook at home. For example, seed germination, volume of water in different forms of container, use of oxygen in burning...my dad helped me. That was so interesting to discover new things... Gradually when I grew up, then I was confident that I wanted to work in the construction field particularly civil engineering.”*

Nisha’s secondary school played an important role in her life as it was an elite secondary school and she was always proud to have been part of it. She described herself as competitive and excelling academically was an important aim for her; she came across as confident. Nisha wanted to study engineering abroad to have international exposure but, due to financial restrictions, she had to study in Mauritius. Nisha was in Year 1 of the BEng (Hons) Civil Engineering.

### **5.3.3 Salima – Case 3**

Salima attended a state secondary co-education school in the rural part of the island, which was amongst the best secondary schools of the island. From kindergarten to university, she had always been with male and female students. Salima was a ‘tomboy’ who was always in her jeans and she avoided wearing dresses, skirts or Asian female outfits. She was tall with her short haircut and her formal learning always occurred in a co-educational context. She liked practising ‘male students’ sports’ and doing typical guy type activities with her two brothers. Salima did not consider engineering a man’s field only, although she knew that there were not many female students in this field. At upper secondary school level, she did Mathematics, Chemistry and Physics. Both her parents were entrepreneurs and they ran a business in the city. Her parents wanted her to become an engineer and that is why she applied to the course, which was her second option. However, Salima’s first option was mechanical engineering. Being in Year 2 of the BEng (Hons) Civil Engineering, she had to fulfil the dreams of her parents as illustrated below:

*“My first option was engineering. Being in Year 2 of the BEng (Hons) Civil Engineering, was a challenge for me, as I have to fulfil the dreams of my parents and to show to the world that there is no difference between boys and girls as had always been the case for me”*

Salima was engaged in engineering, as she wanted to break the stereotype that engineering was meant for male students only.

#### 5.3.4 Olivia – Case 4

Olivia attended a private Catholic single-sex secondary school in the central and urban parts of the island. She was in Year 2 of the BEng (Hons) Civil Engineering. Before joining university, for seven years, she had been with female students only during her secondary schooling. Olivia studied all the science subjects (Chemistry, Physics and Biology including Mathematics) at upper secondary education. She did Chemistry, Physics and Mathematics as the main subjects whereas Biology as subsidiary subject for the Cambridge Higher School Certificate Examinations. To experience international exposure, she wanted to study engineering abroad but due to some financial limitations, she was enrolled on the engineering programme at Fly University. Olivia's mother was a primary school teacher and her father worked in a bank. Olivia had an elder sister who was an accountant. During her secondary schooling, Olivia was a good athlete and participated in inter-school sports competitions.

#### 5.3.5 Mia – Case 5

Mia attended a co-education state secondary school in the rural part of the island, which was amongst the best secondary schools of the island. Mia attended the same secondary school, as Salima and they had been friends in secondary school. From kindergarten to university, she had always been with both male and female students. Mia had always liked building and designing things and she had many cousins who were engineers, so engineering was a field that she always thought she would love to do. Mia was inspired by her cousins, as shown below:

*“I have always liked building and designing things and I have many cousins who are engineers and so civil engineering is a field that I always thought I will love to do.”*

Being in Year 4 of the BEng (Hons) Civil Engineering, was quite stressful for her, as she found the course difficult and did not want to fail any module. Mia considered herself very lucky and proud to be enrolled on the programme, as the demand for the programme was very high and only the best applicants get the opportunity to do it. Mia found the job of an engineer attractive as it creates, improves and protects the environment.

#### 5.4 Section 2: Thematic organisation of the findings of critical individual conversations

In this section, the cross-case presentations would focus on a process of discovering commonalities and differences about the findings of the five cases through the critical individual conversations. The theoretical framework guided the study in the data analysis process. The critical individual conversations of the five cases identified the most significant influences of the gender regimes presented in the learning experiences of female engineering students and examined these in relation to the existing knowledge, as shown in the review of the literature. The different themes that emerged from the critical individual conversations during the process of data production are presented in this section. The narratives of each case are argued in the thematic areas of questioning.

The findings from the participants' responses are presented according to the main themes namely: male students as superior, single-sex education/co-education, physique and differential treatment by academic teaching staff. These are then expanded into sub-themes. A thematic presentation of the participants was adopted instead of a case-based presentation of the participants. Such a presentation enables the demonstration of the similarities and differences that exist amongst the participants, rather than presenting them separately for each participant.

For a more intensive study the themes were structured around the following as in Table 5.

Data driven		Corresponding literature
Main themes (Data production categories)	Sub themes (Emanating from data)	
<i>Male students as superior</i>	<ul style="list-style-type: none"> <li>• Men with hegemonic masculinity</li> <li>• Men with alternative masculinity</li> <li>• Protective men</li> </ul>	<ul style="list-style-type: none"> <li>• Patriarchy</li> <li>• Power</li> <li>• Anticipatory socialisation</li> <li>• Cultural ideologies</li> </ul>

	<ul style="list-style-type: none"> <li>• ‘Friendly’ and ‘supportive’ men</li> </ul>	<ul style="list-style-type: none"> <li>• Negative stereotype</li> <li>• Chivalry</li> </ul>
<i>Single-sex education/co-education</i>	<ul style="list-style-type: none"> <li>• Women only</li> <li>• Women and masculine positionality</li> <li>• Women preferring a single-sex environment</li> <li>• Women as equal as men</li> </ul>	<ul style="list-style-type: none"> <li>• Learning collaboratively</li> <li>• Success by staying feminine</li> <li>• Success by adopting masculinity</li> <li>• Patriarchy</li> </ul>
<i>Physique</i>	<ul style="list-style-type: none"> <li>• Undoing hegemony: physically weak</li> </ul>	<ul style="list-style-type: none"> <li>• Gender role</li> <li>• Gendered symbolisations</li> <li>• Gendered stereotyping through body image</li> <li>• Nature of engineering</li> </ul>
<i>Differential treatment by academic teaching staff</i>	<ul style="list-style-type: none"> <li>• Supportive academic teaching staff</li> <li>• Hegemonic academic teaching staff</li> <li>• ‘Special’ academic teaching staff</li> </ul>	<ul style="list-style-type: none"> <li>• Power</li> <li>• Gender segregation within professions</li> <li>• Cultural ideologies</li> <li>• Gender role socialisation</li> <li>• Chivalry</li> <li>• Role model</li> <li>• Feminist approach</li> </ul>

**Table 5: Classification of themes**

Table 5 illustrates the classification of themes. There were four main themes, namely: male students as superior, single-sex education/co-education, physique and differential treatment by academic teaching staff. These themes were produced deductively and interpretively in the data production phase, focusing on these aspects of experiences. The sub-themes, which varied according to the main themes, were indicative of the specific aspects that influenced the learning experiences of the participants. These included the following:

- Men with hegemonic masculinity
- Men with alternative masculinity

- Protective men
- ‘Friendly’ and ‘supportive’ men
- Women only
- Women and masculine positionality
- Women preferring a single-sex environment
- Women as equal as men
- Undoing hegemony: physically weak
- Supportive academic teaching staff
- Hegemonic academic teaching staff
- ‘Special’ academic teaching staff

The themes and sub-themes were also discussed with corresponding literature.

#### **5.4.1 Male students as superior**

Superiority was depicted through patriarchy, masculinity and power when male students deprived female students from joining class discussions and thus, female students were deprived of being active in classroom interaction and learning. Class discussions, concerning how to align lectures and notes from textbook to the fieldwork, offer a context for students to comprehend technicalities of the content better (Du & Kolmos, 2007, pp. 38-39). These masculinising discourses structured a gendered hierarchy that differentially positioned male and female students in the classroom (Leyva, 2017, p. 415). In this study, the positioning of male students as superior was found to be a central feature of the gender regime present in the higher education institution studied. This is expanded upon in greater detail below.

##### **5.4.1.1 Men with hegemonic masculinity - Emma and Nisha**

The concept of hegemonic masculinity was coined to grasp both men’s patriarchy and privileges (Connell, 1985). Johnson (2005, p. 5) defines patriarchy as a system of male privilege that means that positions of power are kept for men. In Emma’s discourse, hegemonic masculinity was shown through the control, sense of superiority and over-confidence of the male students towards female students when the latter were not able to give correct answers to questions in class, thus enforcing

marginalisation of women by making them less independent, persistent, and vocal.

Emma reported:

*“The boys did not talk to girls at the beginning. They could understand the concepts explained in class and were able to give correct answers to the lecturer whenever he asked questions in the class. Once a lecturer asked my friend a question, she was not able to give the correct answer because the concepts were not clear to her... After the class, one of the boys told my friend that the answer was so easy and that he did something like that before in Higher School Certificate. He said that he could not understand how she could not give the correct answer.”*

Male students attribute intellectual superiority to them and used this justification to consequently reject female students and their problem-solving inputs to class discussions (Leyva, 2017, pp. 414-415). Such perceived intellectual superiority was a dominant form of masculinity performed in the setting, often demonstrated through the over-confidence of male students. In many instances, this was based on societal expectations for men and their gender perceptions about masculinity and engineering. Emma commented on how male students referred frequently to their excellent performance at secondary school examinations and how this would allow them to excel in all modules in the programme, as highlighted below:

*“...once a boy from my class said that he was always first in all subjects in secondary school and that he was also ranked in the Mauritius top 500 scholarship listing and he was confident that he will excel in many modules and that he will graduate with a first class. I was so shocked when he said these words.”*

According to Hirshfield and Koretsky (2018), male students talked more and were more likely to answer questions and discuss technical issues in the classroom compared to female students. Emma’s interpretation of classroom experience focused on the power that male students exercised by the sheer fact that they were superior in numbers. For example, as shown below, they monopolised the oral space of the classroom by answering all the questions, thus depriving female students of an opportunity to participate, which highlighted that the majority group in class is the male grouping:

*“Sometimes in class it is still the same with other boys. They still behave as if they know everything. For example, they would try to answer all the questions asked by a lecturer and will not even listen to the others or will not even give other students a chance to answer the questions. They want to get all the attention of the lecturer and sometimes this becomes a one to one conversation for about ten minutes between a boy and a lecturer.”*

The last sentence of the above extract clearly indicates that Emma felt excluded from a long one to one conversation between male students and the lecturer. The attitude of the male students created a gendered environment, which made female students realise that they were in a field perceived socially to be for men. Men dominated the learning space and perceived themselves to be intellectually more superior to women. Although, the male peers had started to befriend Emma, the latter acknowledged that she was at the receiving end of some form of gendered disadvantage because she was a female student:

*“I felt conscious that I belonged to the minority group being surrounded by the opposite gender. I have got used to it now. After some weeks, the boys started talking to the girls in class. I have gradually accepted this situation and it seems that the boys have started to accept me as sometimes they talk to me during lunchtime.”*

According to Kontio (2016), the male identity often demands a skill in a specific masculine jargon such as teasing, jokes and foul language use in a tough atmosphere in school. A gendered environment was also articulated through the coarse language used by the male students in class that was not appreciated by Emma who resented it as shown below:

*“I did not appreciate the way some of the boys reacted in class. Their language was so rough when they talked amongst themselves... For example, the boys were using foul language in most of their conversation. Now I am used to their behaviour or language used. I think that at the beginning, that is in Year 1, they wanted to show us the girls that they are more intelligent than us and that they are the majority in class by showing us they were superior.”*

After one year, however, Emma experienced a change in the attitude of male students. According to Cyr, Donald and Bergsieker (2020, p. 6), male students become more open to sharing with the female students, as men tend to befriend and respect peers who are competent. Such attitudes of the male students showed that they were getting used to the female students, or perhaps their perceived dominance was being challenged by the female students who were doing better than them in the studies. Friendship ties are important for students in educational contexts and these can be powerful tools to facilitate social integration (Boda, Elmer, Vörös & Stadtfeld, 2020). Mixed-gender friendship relations between students of different

gender created mutual understanding and such a change in attitude was highly appreciated by Emma who experienced these moments as friendly and encouraging:

*“I have seen that the boys also have changed. They listen to girls now. For example, one day, one of the girls told me that she wanted to have a look at the answer sheet of a returned assignment of a boy as the lecturer said that that particular boy gave an excellent answer to a particular question and the lecturer also recommended that all students should have a look at the answer after the class. ...Without hesitation, he gave the answer sheet.”*

Emma’s discourse showed that in many instances, the engineering field was often highlighted as a man’s field which made the male students unfriendly, unsupportive, arrogant, over-confident and vulgar towards the female students. The gender regimes contributed to making engineering a masculinised domain in which “students discursively negotiate their identities and practices with gendered norms and experiences” (Leyva, 2017, p. 398). Such approaches could create moments of doubt about women’s ability and could have compromised their persistence in the engineering field. However, male students sharing correct answers with the female students did not in itself challenge hegemonic masculinity. The situation might not have been the same if male students did not outperform female students. However, it is not clear whether familiarity made sharing easier by a process of “getting used to” or accepting that it was men’s ways of being or whether the attitude of male students mended with time.

Like Emma, Nisha also experienced open hostility, competitiveness and derogatory gendered comments from the male students. She also noted that she developed courage to face her male counterparts by starting a conversation with them, as illustrated below:

*“Everything depends on a person’s personality on how different situations are handled. I was the first one to go and start a conversation with the boys as I had no option to talk to them when we had group work but had to listen to their mockery and ignore them, at the same time. Most of the time, during group work, they make as if they did not hear what I said...During group work, they also make nasty and sexist conversation among some boys but I pretend to be deaf. Not all the boys in the group make such conversations, which make them respectful towards girls and I feel good.”*

The findings above are not different to others found by scholars elsewhere. For instance, Beaman, Wheldall and Kemp (2006) note that, in science classrooms, male

students tend to dominate group discussions. Some of the participants' voices were under-represented in the classroom as they participated less in class discussions due to the dominant heteropatriarchal discourses. Nisha reported that some male peers demonstrated gendered positions through their participation in class discussions and she did not get a chance to participate in these, as follows:

*“Most of the time I don’t get the chance to participate in class discussions because the boys keep on talking unless the lecturer asks them to listen what the girls have to say. If ever the girls get the chance to say something, then the discussions become like a debate between two teams – boys and girls. The boys keep on defending their arguments. But some lecturers stop them by giving his/her conclusion about the topic to close the discussion.”*

Higher education institutions could consider gender differences in the learning process, especially when traditional teaching methods are still being used. The institutions could develop teaching styles that would improve the learning experiences of students (Kulturel-Konak, D'Allegro & Dickinson, 2011, p. 16). The patriarchy, hegemonic masculinity and power that are practised by some male students are informed by processes, which according to Shawver and Clements (2015, p. 558) are “established socialization... during childhood”, when children are taught about the meaning and gender roles of men and women (Crespi, 2003). Gender socialisation supports patriarchy, hegemonic masculinity and power among men. In an educational setting, the normalisation of male students in science majors participating in classroom discussion considerably more than women may impact what men and women believe as normal (Ballen, Danielsen, Jørgensen, Grytnes & Cotner, 2017, p. 266). This ‘normal interaction’ at Fly University was about patriarchy, hegemonic masculinity and power and thus shaped the regime and gender order at Fly University. Such unwelcoming learning spaces created male-classroom hegemony during classroom discussions.

Both Emma and Nisha identified the dominant model of hegemonic masculinity in learning spaces and how it affected and inhibited their learning experiences. Facing such hegemonic traditions demonstrated the gender-based challenges faced by female students in male-dominated fields. The gendered beliefs strongly influenced the behaviours and perceptions of the male peers, which biased their expectations and understandings of the female participants (Blosser, 2017, p. 27). These cultural

gendered stereotypes often led to making the male peers believe that engineering was suited to abilities that were based on their gender (Blosser, 2017, p. 27).

#### 5.4.1.2 Men with alternative masculinity - Nisha and Salima

Nisha identified the different degrees of resistance manifested by male students in relation to female students' engagement in engineering as a field of study. At one extreme, there were male students who indicated their disinterest by not engaging with female students except for compulsory group work. These male students contributed immensely to the gendered environment through their seemingly indifferent attitudes towards female students because they always stayed in their comfort zone with male students only:

*“There are some boys who are not even interested to talk to girls. They prefer to make friends with the boys only. I qualify such boys as macho-type boys.”*

Like Nisha, Salima also reported that some male students preferred not to talk to female students. Male students showed preferential treatment towards other male students as being more knowledgeable and competent than the female students (Salehi, Holmes, & Wieman, 2019, p. 2). This showed that there was a group of male students who were very aware of how gender mattered in the field of engineering. Such male students were so engrossed in their studies that they might consider female students as being a disruption to their studies. Thus, they refrained from talking to female students, as reported by Salima:

*“I have the impression that initially, some boys were afraid to talk to me or approach me... although very rarely they talk to other girls. In fact, there are two boys like that in my class. When I approach them, they try to ignore me.”*

*“Those boys who I qualified as being bookworms, as they never play football. Once such a boy told me that I am a tomboy... I found such comments very flattering. However, I do not like moving around with such type of boys as they also do not like mingling with girls. I think that these boys are very shy and they communicate only with a smile and they do not want any kind of distraction. I do not really talk to such type of boys. I think that strong and weak people are present in both genders, and I consider girls equal to boys.”*

According to Reasenber (2017, p. 22), in a male-dominated field, women are more likely “to experience an academic climate they find unattractive, uncomfortable and perhaps even hostile to their academic pursuits and interests”. Women tend to find protection from peers for a stronger network of social support. “...women reinforce

their role as recipients of protection” (Sasson-Levy, 2003, p. 443). In the case of Salima, as shown above, she felt flattered when she was being referred to as a tomboy by her male peers and this gave her privileges that other female students did not have. This showed that women found protection by being part of the male peers’ group in a stereotyped field such as engineering. Protection, which is based on subordination, is also associated with masculine dominance where men are perceived as the protector of women.

Connell (2005) recognises that the dominant masculinity discourse encourages a form of masculinity that challenges that men should be powerful and women should be feminine. Thus, the male students who preferred to stay away from female students conformed to or derive benefits from hegemonic masculinity. These male students chose to show their patriarchy, independence and power towards female students by belonging to the boys’ group only. This type of protection from peers belonging to the same gender is related to the protection of patriarchy and preserving socially structured power relations among men (Fahlberg & Pepper, 2016, p. 675). Such a construction of belonging, based on cultural assimilation, thus reinforces hegemonic masculinity, which is disadvantageous for women in the field.

#### 5.4.1.3 Protective men - Mia

According to Wolfe’s (2019, p. 11) study, it was found that women who attended co-educational schools described their feelings about Mathematics as “just like any other subject”. Interacting with male peers was reported to be totally unproblematic in Mia’s case, as she had been schooled since kindergarten in a co-education environment as shown in the extract below:

*“Since kindergarten I have always been with both boys and girls. There is nothing new here for me.”*

In Hindu mythology, ‘Raksha Bandhan’ symbolises the brother protecting the sister and same was celebrated by Mia and her two male peers:

*“Since Year 2, I celebrate ‘Raksha Bandhan’, with two of the boys in my class and they are very supportive and consider me as their sister.”*

In Mia’s case, ‘Raksha Bandhan’ placed the male peers in a dominant position which they liked to accept by making Mia’s relationship with them so unproblematic as she

readily cast herself in the role of weak and needing protection, thus making men chivalrous protectors of women (Sandberg, 2013). These experiences would provide Mia with a stronger sense of emotional and physical safety that allowed her to abide to gendered norms. Mia's discourse showed that being in a male-dominated class was not a problem for her. She never felt that she belonged to the minority group – the female students.

This also reflected on what Salima experienced with her male peers. As argued above, the construction of belonging was based on subordination and cultural assimilation. Salima's discourse of belonging as presented in Section 5.4.1.2, was also based on a construction of sameness, assimilation to masculinity. The process of assimilation here seems important as it "...equates to a process of appropriation or assimilation of difference into sameness, so that which was different – 'the other' – is no longer so" (Lewis, 2000, p. 57). This showed that female students, who performed cultural assimilation were not perceived by the male students as something 'other'. This was depicted by Mia and Salima, who assimilated masculinity and they were very much accepted in the field.

With two male students of her class, Mia even shared a brother-sister relationship, which portrayed men as physically superior to women, which remains a hegemonic patriarchal ideology (Cousineau & Roth, 2012). The constructed image is that women are naturally weak and unable to protect themselves and thus they need to be protected by men.

#### **5.4.1.4 'Friendly' and 'supportive' men - Nisha, Salima, Mia and Olivia**

Nisha's experience spanned the entire gamut of possibilities. On the one hand, she experienced masculine dominance and on the other hand, she was also accorded respect by some of her male classmates. The exception to the rule appeared to be two male peers whom Nisha reported as being supportive, as demonstrated by her comment below:

*"However, there are only two boys in my class who are polite with girls, for example, they would share their notes with me whenever, I asked them."*

*"In Year 2 they are more friendly. I think they have grown up... they do make comments, but rarely. Now I don't ignore their comments, I always give them a*

*reply.*”

The above suggested that having female students around and seeing female students doing well made the male students to move outside masculine dominance. Nisha’s discourse revealed that she developed a new set of skills in dealing with her male peers and the comment above illustrated her growing assertiveness. Her own perspective on the comments of male classmates appeared to have changed. In fact, in her second year she chose to interpret their continuing comments on her physical appearance as a manifestation of their own insecurities and anxieties. Those comments were bound to make Nisha uncomfortable, unhappy and unwanted in class, but Nisha did not let such comments affect her studies, as she was a brilliant young woman. Such unpleasant comments forced Nisha to stay away from the male students, thus, to be in the female students’ group. Although some male students appeared to be polite with female students, most of the male students showed gendered attitudes to power, in their interactions with female students by embodying hegemonic masculinity.

Connell (1987) argued that hegemonic masculinity is built in relation to four non-hegemonic masculinities namely: complicit masculinities, subordinate masculinities, marginalised masculinities and protest masculinities. Complicit masculinities do not embody hegemonic masculinity although they recognise the benefits of unequal gender relations and help sustain hegemonic masculinity; subordinate masculinities are built as lesser than and different to hegemonic masculinity, such as effeminate men; marginalised masculinities are discriminated against because of unequal relations external to gender relations, such as class, race, ethnicity, and age; and protest masculinities are built as compensatory hyper masculinities that are formed in relation to social positions lacking economic and political power. Nisha’s discourse shows that two of her male peers may have performed subordinate masculinities towards her. Subordinate masculinity stands in direct opposition to hegemonic masculinity (Kenway & Fitzclarence, 1997). By being helpful, supportive and polite towards Nisha, the two male peers performed non-hegemonic masculinity.

Like Nisha, Salima also experienced respect from some male peers, which she

highly appreciated. This showed that the male students were conscious that there was a female student in their group, so they were respectful towards Salima:

*“During these two years of study at university, I have always received respect from my male peers as I find that they even hesitate to flirt with girls or to use foul language when I am around.”*

Salima believed that she felt at ease with the male students, more precisely, she felt as one of them by just being herself and by being honest. Women are perceived to be gossipers (Davis, Dufort, Desrochers, Vaillancourt & Arnocky, 2018, p. 1). Salima's belief that women are gossipers played to the same sexist connotation that men have about women as being gossipers. Salima found the male students honest, as most of them did not like gossiping. Being herself a woman, Salima associated female students with gossiping, showing her gendered belief towards female students:

*“Once, I even helped one of the boys, to change the tyre of his car, which got punctured. They all said “Wow, how do you all these?”... I often watch football matches videos on YouTube with the boys... I find the boys honest as they involved in boyish conversations for example they would talk about construction of vehicles, etc, instead of gossiping. I have never bothered how a girl should look like. I have always been myself – a tomboy”.*

All individuals, regardless of their biological sex, can perform different forms of masculinity. The performance of masculinity is associated with the growth of position and power (Alsop Fitzsimons & Lennon, 2002; Connell & Messerschmidt, 2005). Some women chose to become part of a masculine group and to become ‘one of the boys’ (Fine & De Soucey, 2005, p. 131). Salima's discourse showed that she adopted a masculine outlook to fit in; this is also part of gender performance, which Butler (1988, p. 520) argues to be non-linear, and unstable. Foucault (1980) claims that power is imposed on individuals by institutions, and individuals comply with the rules, norms and values of the institutions by conforming to masculine dominance. Salima's experiences of adopting the need to push beyond her femininity to conform and be part of the boys' group, speak of the rules that enable acceptance into the engineering field. It demonstrates the ways in which power could operate in the context. It also speaks to the ways in which gender is performed, confirming that gender is not a natural fixed performance, but rather that it is performed differently according to the context, the space and time.

Mia's learning experience with the male peers had helped her to integrate herself in this field. She did not encounter any difficulty with the male students, as they were friendly with her. The male students were helpful to her during group work and in fieldwork and, according to Mia, her male peers acknowledged her ability even when in situations when she was better than them:

*"Obviously I cannot speak for all boys or all engineering students, but I felt comfortable in the presence of the boys. None of the boys in my class think less of female classmates. I am friendly with all the boys of my class. They are also very cooperative during group work and fieldwork."*

In line with Mia's discourse, unlike the other participants, Mia did not notice any form of hegemonic masculinity amongst the male peers. The male students as well as Mia were comfortable with each other and friendly. Part of this friendliness was linked to the reproduction of masculinity within the context. Mia's interpretation also showed that the male students demonstrated their physical strength during fieldwork:

*"During fieldwork, which I find extremely exhaustive as I had to stand for hours in hot sun while wearing a hard hat, the boys helped me to lift a brick. I was happy as they were very helpful on the construction site."*

According to Mia, although the female students belonged to the minority group in her class, the male students of her class were nice and helpful. Mia believed that each female and male student was different and understood things differently. This is most evident in the joy she expressed about the male students picking up the brick for her. Furthermore, she noted that:

*"Even when I find difficulty on a specific topic, I ask my classmates first before asking the lecturer. I once had asked two boys about clarification on a topic - 'Design Project' and they both explained it basically in a similar manner. Therefore, I did not have to ask the lecturer."*

During group work the male students and the female students helped each other and the discussions were very interesting. According to Mia, the male students were comfortable with her and vice versa and they never tried to impress her. Instead of focusing on trying to get the attention of the opposite gender, the male students and female students all focussed on learning:

*"The boys of my class did not see any difference between us. They often told me that 'you are so studious'. I shared notes, had lunch meals with the boys and I never encountered any sort of discrimination from the boys towards me."*

*“During group work we all help each other and the discussions become very interesting...I was comfortable with the boys and it was the same for them. They neither tried to impress me nor did I.”*

In Antarctica, it was found that gendered barriers to participation in fieldwork in STEM persist for women (Nash, Nielsen, Shaw, King, Lea & Bax, 2019). Mia’s discourse shows how male students exercised their masculinity particularly on fieldwork and showed to female students that they were physically more powerful than women. Although Mia claimed that some male students were helpful, they demonstrated power and masculinity.

After spending one and a half years at Fly University, Olivia’s relationship with the male peers was still not favourable, as she still felt uncomfortable when male students were around. Adapting to the university environment was still difficult for her. Her learning experience with her male peers showed that, although she found the male students polite and helpful, due to her introvert nature, she preferred to refrain from interacting much with them and with the female students:

*“After having spent more than a year and a half at university, I feel that I have still not made my place here. As I do not like talking much, I still feel uncomfortable among the other students – boys and girls in the class. The initial days in Year 1 were like a hell for me.”*

Unlike Emma and Nisha, Olivia’s learning experience with her male peers showed that she found the male students nice, polite and helpful although she did not like interacting much with them. Olivia reported that although some of the male students were polite and helpful to her, her relationship with them was only restricted to the class and group work:

*“In the first year, the boys approached me to make friends with them, but I do not feel at ease with them. I talk to them whenever we have a group work otherwise, I prefer to be on my own. However, during group work, I find the boys nice as they listen to my views. They are polite with me and are not rude and I find them friendly for example, they will ask me if I want to go to the cafeteria with them. They also used to tell me what other students think of me, even if I was not interested to listen to whatever they were saying. Whenever, I need help on a particular topic, they are ready to help and support.”*

Some women did not feel the need to try to fit in with the male students (Hoffert, 2008). However, despite the gendered nature of institutions, it is clear that

individuals have the potential to resist dominant and gendered ideologies. Olivia appeared to resist hegemonic forms of masculinity. Although some male students proved to be helpful and supportive towards her, she did not attempt to join in with the male students. It appeared that the male students accepted Olivia, regardless of her introverted nature. Olivia's discourse reflects the ways that helpful men who are possessors of masculinity may contribute to a change with regards to gender in the field of engineering.

The discourse of Nisha, Salima, Mia and Olivia showed that some male students were friendly and at times supportive towards female students. However, they still played to the expectations around masculinity. As shown by the findings of this study, fieldwork was a learning space where men could show their physical power and the classroom was a learning space where men could show their intellectual power. The gender regime was thus constituted by the overt performance of masculinity, chivalry and attempts to emphasise academic prowess.

#### **5.4.2 Single-sex education/co-education**

Secondary schools, which comprise both single-sex and co-education secondary schools in Mauritius, were central to the educational environment within which individuals grew, as stated in Section 1.3.1.3 of Chapter 1. The type of secondary school attended by the participants was one of the main forces that shaped their relationship with their male peers. For example, Salima's and Mia's learning experiences regarding the relationship they shared with the male students were different from Emma, Nisha and Olivia. According to El Nagdi and Roehrig (2019), some female students found it hard to adapt to an academic environment where they had to deal with both male and female students. The findings corroborated those of Li and Wong (2018, pp. 6-7) who found that students who attended single-sex schools were more likely to have a higher proportion of same-sex best friends than the students who attended co-education schools.

On one hand, Salima's and Mia's co-education secondary school showed that co-education secondary schooling reflected the reality of an increasingly open and interconnected world that comprised both male and female students. The findings related to Salima and Mia were consistent with the literature, which states that

students who have more gender opposite peers in their neighbourhoods have more opposite gender school friends (Hill, 2015, p. 148). On the other hand, Emma, Nisha and Olivia, who all attended single-sex secondary schools, found it difficult to socialise with the male students when they first joined Fly University.

#### 5.4.2.1 Women only – Emma

In describing her learning experiences in the engineering major, Emma had started with a positive image of the engineering field, as she thought that the engineering field was not restricted to male students only. She was confident that she would complete her studies with high grades. Emma noted that in secondary school she had never felt as uncomfortable as when she first joined Fly University. Her early learning experience with her male peers at Fly University was a challenge, as she described the behaviour of those male students who expressed their dissatisfaction about female students doing engineering as inappropriate and gender biased. Emma, Nisha and Olivia found the relationship with their male peers a challenge and a source of anxiety. Emma commented on the co-education university environment as follows:

*“It was weird at the beginning to be surrounded by mostly boys because it was not the case in secondary school.”*

*“Some boys would always say that engineering is not for girls.”*

According to Smith and Gayles (2018, p. 11), women perceived the gender-based first impressions with male colleagues as unwelcoming. Emma described the university environment as unwelcoming since there were few interactions between male and female students. She further elaborated on how it was difficult for her as shown below:

*“I was used to female students being around at secondary school and was comfortable and at ease with all my friends. I never felt weird. The first few weeks of Year 1 were not easy for me. The first day, I was on my own and this phase was really intimidating; the first day was awful. When I first entered the classroom, I was really anxious as I felt as if all the boys’ eyes were on me and this was quite embarrassing.”*

It appeared that Emma’s experience of secondary schooling had an influence on her adaptation period at university, as she was not comfortable being surrounded by

male students. She had been surrounded by female students for seven years during her secondary schooling and this gender segregation in secondary education proved to be useful for her, giving her confidence in her studies, particularly in the science subjects, as she was amongst the best students of her class. She reported that, during her secondary school days, she was never self-conscious about what her friends would think about her when she jumped into class discussions especially on the human reproduction chapter in Biology. At secondary school, she would express her views freely without thinking what her classmates would say as illustrated by her comment below:

*“In secondary school, I was also amongst the best students in class ...as I scored high marks in mostly all the subjects. Euh I always participated joyfully without thinking about what others would say and think about me, to the class discussions especially the ones on human reproduction chapter in the Biology class, which was very interesting.”*

At the university Emma found similar supportive approaches amongst female students. These were characterised by friendship and motivation leading to persistence in the course. Emma found the situation less difficult to cope with, and commented on the moral support she received from the presence of other female students of her class in the face of adversity, as shown below:

*“... We, the female students, encouraged and supported each other morally by trying to boost our confidence level. I remember, the first week some of my friends who were female students, wanted to leave the course. They said that the modules were so difficult and that the environment here was not welcoming.”*

The above experiences concurred with findings from literature on the workplace, where women often found their male peers arrogant and dominating. This was often based on gender prejudices about the innate skills of men and women (Seron, Silbey, Cech & Rubineau, 2016, p. 11). A possible explanation to such attitudes in the engineering field relates to how men have always positioned themselves in positions of power, even in the workplaces. Such a situation was also present in higher education, as revealed by Emma, who explained how one of her male peers responded arrogantly when one of the female students could not give a correct answer to a question in class:

*“...the boys were arrogant...He even added that if she could not give a correct answer to such an easy question, how would she be able to understand more complex concepts or work in a place where there would be only men”.*

According to Smith and Gayles (2018, p. 11), women had the impression that their male colleagues had negative assumptions about their competency. Although the male students had a tendency to undervalue the female students, as shown in the extract above, consciously or maybe unconsciously the female students opposed these damaging attitudes by their high performance in the assessment, as depicted by Emma in the extract below:

*“I must admit that the girls in my class are very serious about their studies because we all score good marks during class test and exams.”*

The findings suggest that single-sex schooling produces solidarity amongst girls. Emma’s interpretation corresponded to the notion of a girls’ group who outperformed male students as found by Seron, Silbey, Cech and Rubineau (2016, p. 11) as well as female scientists who used their knowledge and skills to assess their success and fitness in the field, as found by Ayre, Mills and Gill (2013). In this study, women increased the solidarity amongst each other, which seemed to empower them. This was often evident in the marks attained and, in the support, and assistance offered during class sessions. Emma’s extract above demonstrates the link between the commitment of the female students to become successful in the engineering field and their persistence on the programme, despite a gender regime that seeks to encourage masculinity and patriarchy.

Nisha, who encountered difficulty at the beginning to integrate at Fly University, experienced the same negative relationship. It was easier for Nisha to make friends with female students, as it had always been the case for her during her schooling, as shown below:

*“I was not friendly with the boys and I preferred to stay with the girls during lunchtime.”*

Like Emma, Nisha’s learning experience with her male peers showed that she was more comfortable and at ease with the female students than with the male students. As Nisha also attended a single-sex secondary school like Emma, initially, she found it difficult to adapt to a co-education environment, as shown below:

*“During my first weeks in Year 1...I felt more at ease with the female students and moreover, one of the female students in the class was in my class at secondary school. Therefore, it was easier to make friends with female students.”*

The traits of brilliance in STEM are usually associated with men (Storage, Charlesworth, Banaji & Cimpian, 2020, p. 37). Nisha reported on the male students in her class, who knew that she had an excellent academic track record given her attendance at an elite secondary school. In her view, this knowledge played against her as she argued that male students in her class saw her as a threat because she could potentially outperform them. Nisha argued that female students scoring higher grades than male students were considered as being a threat for the male students. She considered that their comments on her physical appearance and small frame were a means of intimidation, as revealed by her comment below:

*“Given that I come from an elite school, the boys wanted to intimidate me...I believe, once they know that a girl comes from the elite school, they lose confidence in themselves...I learnt that boys do not appreciate when female students do better than them in class.”*

In an academic setting where masculinity is associated with intelligence and competence, male students seem to have wider possibilities to be recognised (Madsen, Holmegaard & Ulriksen, 2015, p. 17). Nisha’s discourse was consistent with the literature, as she found herself at risk of being rejected for not being intelligent enough as not clever enough by their male peers, who would not accept women outperforming men in an engineering field. Indeed, the fact that she came from an elite school further exacerbated the problem, as the male students sought to undermine her privilege and power accorded to her through a class-based system. This reveals the complex ways in which gender power entangles with economic power to produce a position of ‘threat’ for men.

#### **5.4.2.2 Women and masculine positionality - Salima**

Belonging to a co-education schooling environment since kindergarten had proved to be useful to Salima in the engineering field. According to Salima, there was no separate man’s or woman’s world. Unlike Emma and Nisha, who attended single-sex secondary schools, Salima had always received respect from her male peers and felt happy when she moved around with them as shown by the extract below:

*“As from kindergarten to university, I had always been with both boys and girls. I consider myself as a tomboy I used to play with the boys at school and I was happy.”*

Salima’s socialisation during her schooling, had contributed to her adaptation to the

university's environment. Salima considered that her nature had enabled her to adapt to the engineering field and to the university environment, which was not the case for Emma and Nisha. Her self-categorisation reflected her desire to be associated with male students rather than female students. Salima captured the “masculine” characteristics of being assertive, ambitious, dominant and independent. Unlike Emma and Nisha, Salima's learning experience with the male peers was enjoyable and she portrayed the relationship with her male peers as one characterised by equality. Engineering was not a man's world and it was not only for male students. Salima said that being in a male-dominated field did not affect her at all. The presence of male students in her class did not matter to her:

*“Well, the boys of my class are quite friendly with me compared with other girls of my class. I feel as comfortable with them as I feel with the girls. I feel comfortable with the boys and I do not need the support of girls to feel comfortable.”*

In male-dominated professional environments, women may feel the need to discard femininity and embrace masculinity to persist and achieve (Seron, Silbey, Cech & Rubineau, 2018, p. 25), as already alluded to above. Connell and Messerschmidt (2005) suggest that hegemonic masculinity demonstrates that societies are deeply gendered and that all things linked to men have the tendency to be given more value than those related to women. This might provide an explanation for the adoption of masculine characteristics by Salima in this patriarchal society.

#### **5.4.2.3 Women preferring a single-sex environment - Olivia**

Olivia's discourse showed that the secondary schooling of the latter had an influence on her relationship with the male peers in her class. As Olivia attended a single-sex secondary school, she was not used to being surrounded by male students. Olivia also stated that she was not comfortable in the presence of male students and, although it was the male students who made the first step to talk to her, she did not feel at ease with them as illustrated below:

*“Today also, each day going to the university is a herculean task for me, since I had not interacted much with boys before. Although, the boys try to start a conversation with me, I am not at ease.”*

She interacted with the male students only when there was group work. However, Olivia was someone who talked less – even with female students – and she

considered herself as an introvert. Olivia's discussion showed that her nature was different from Emma, Nisha and Salima as her introvert nature hindered her relationship with her peers, as shown below:

*"I am an introvert. I do not talk much, even with girls. That is why everyone told me that I am a bookworm and that I study all the time as I was always in the library during my free time. I wanted to leave the course but escape is not the solution. I had to face it. I need to have a degree. I hope to be out of that one day. In fact, I do not really have friends here – even if they are nice to me."*

Olivia had never experienced any kind of rudeness from male students who tried to be friendly with her, unlike Emma and Nisha who found some male students rude. Male students were polite with Olivia and were always helpful, which concurred with Salima's learning experience with her male peers as she also found the male students helpful. Patriarchy is a society in which men have most power, to which women tend to be submissive (Des Roches, 2017, p. 4). This showed that male students were helpful with female students who comply with one or other gender stereotype – Salima as a woman adopted a masculine personality and Olivia as a woman was submissive. In some way, Olivia was an example of compliance to patriarchy and hegemonic masculinity. It was also observed that she portrayed what was deemed as 'appropriate' gender behaviours.

#### **5.4.2.4 Women as equal as men: experiences of co-education – Salima and Mia**

It is found that both Salima and Mia, who attended co-education secondary school, had positive learning experiences with their male peers. Their discourses did not reveal their identifying any difference between male and female students at the university.

According to Salima, there was no difference between men and women, and integrating in the university environment was not an issue for her, as she has always been comfortable with male-female relationships, as shown in her discourse below:

*"...to show to the world that there is no difference between boys and girls as had always been the case for me...The boys are quite friendly with me. We are a team, it does not matter whether you are a boy or girl...we stay together, when we watch the football matches, the other girls either talk among themselves or they watch other things on their mobile"*

According to Ainane, Bouabid and El Sökkary (2019, p. 67), some female students enrolled on STEM subjects to make their families proud. This shows that admission to an engineering programme was considered as a prestige for young women. Mia focussed on the demand for the engineering field on the labour market and she felt lucky to be able to enrol on the engineering programme, as shown below:

*“I consider myself very lucky and proud to be enrolled on the programme as the demand for the programme.”*

Co-education schooling had shown to be helpful for both Salima and Mia in terms of their personal and social development, which had greatly helped in their relationship with their male peers. According to Banat and Dayyeh (2019, p. 116), in a co-educational school environment, both male and female students work as a team by exchanging ideas and the presence of both genders shows a worthy peer connectedness. Transitioning to a different educational setting can be complex and may require the coordination and planning of actions (Brault, 2005). The discourses of Salima and Mia showed that co-education might have brought a smoother transition to university life.

### 5.4.3 Physique

Participants revealed, by means of their physical appearance and their discourses, two perspectives of body image, which could be framed as feminine women and masculine women. “The male was described with pants or trousers, while the female was described with a skirt” (Elbalqis, Wijaya & Rohmatillah, 2020). Some participants with long hair, plaits, skirts and, being physically small, demonstrated the gendered symbolisation of femininity. The less feminine female students were characterised by playing football, having short hair and being comfortable with coarse language.

According to Du and Kolmos (2007, p. 36), there is a strong relationship between the engineering community and male gender roles. Companies in building and construction discriminate against women in the recruitment process (Dainty, Bagilhole & Neale, 2000). According to Hossain and Kusakabe (2005), the main hurdle found by women who are engineers in Thailand and Bangladesh is found in the way recruitment is done in favour of men for tasks such as cost estimation, mapping and documentation. A study conducted by the Occupational Safety and

Health Administration in the United States (1999) revealed that most instruments, equipment and clothing in the construction field are not designed for women's physique. It seemed that these factors associate women with weakness and the societal gender stereotype that ascribes physical strength and endurance to engineering have negative consequences for women.

Women in STEM have to struggle with gendered stereotypes, which cause them to doubt their abilities (Drury, Siy & Cheryan, 2011, p. 265), at times, simply on the basis of their looks, as argued in a study conducted with teenagers that found that young women "perceive they cannot be attractive" in STEM (Berg, Sharpe & Aitkin, 2018, p. 113). Emma, Nisha and Mia shared similar relationships with their male peers with regard to a stereotypical belief that engineering was not a field that was fit for women as it required a lot of physical strength that most female students enrolled on the programme, did not possess. The male students doubted the abilities of the women, which made them believe that engineering was not for women, although some participants enjoyed fieldwork and were 'physically fit' for it.

Salima was considered a tomboy who was always in her jeans and avoided wearing dresses, skirts or Asian female outfits. She was tall and had a bossy look with her short haircut. She denied the significance of gender difference but lived it by calling herself a 'tomboy'. Salima was considered as being physically fit for fieldwork by her male peers only because she was physically strong, unlike most female students. The male peers considered women to be slim and weak, thus not suitable for fieldwork and Salima was confident that her body image was appropriate for fieldwork as shown below:

*"...I am fit for fieldwork as I am a physically strong girl compared to other girls who are slim and weak."*

It was clear from the data that some male students who based their judgement of who was appropriate on body image and behaviours determined the acceptance of female students into the engineering field. Salima was physically active, was confident, found ways with male students, was physically strong and stood up for herself. She believed that female students could be on a par with male students, even on the football ground:

*“Sometimes I join them on the playground when they play football. I have beautiful experiences especially when I scored goals. Then the boys are so proud of me... they make feel that I am part of their team for example, they would call me “nou zouer” – our player.”*

According to Nurhadi, Salamah, Destari and Suseno (2018, p. 328), when masculine women obtain positive responses from others, they are happy because there are some people appreciating their appearance. Salima felt happy when the male students did not associate her with the other female students. She felt flattered when the male students told her that she was fit for fieldwork, as she was physically strong. It is interesting to note that Salima’s adopted ways of resisting and gender performance were often found to be acceptable by the male students. As alluded to above, it was well in line with the performance of masculinity, which served to advance hegemonic masculinity. It is interesting to note that similar studies have found men to generally be accepting women who demonstrate masculinity. According to O’Driscoll (2019, p. 13), tomboys are considered as strong. Reay (2001, p. 162) claims that the notion of the tomboy represents a weakening of traditional concepts of femininity. STEM subjects, which are culturally male-dominated fields, are seen not to be taken by women who invest heavily in femininity (Gonsalves, 2014). By accepting Salima who is a tomboy in their group, the male students reinforce the belief that associates masculinity to engineering. This could be in general because Salima’s position does little to threaten the male students’ position of heterosexual performance and presents Salima as being ‘one of the boys’. The male students associated the physique of a woman with engineering, particularly in fieldwork. Therefore, the male students found a strong link between strength and engineering and considered Salima as being different from other female students:

*“The boys of my class usually tell me that I am not like the other girls.”*

Salima’s discourse showed that physical strength represents the dominant version of masculinity, as she was often praised for her physical strength. At the same time, the physique of men is also portrayed as aggressive, smart, strong, active and self-confident (Thébaud & Charles, 2018, p. 8). Salima’s physique was thus connected to hegemonic masculinity.

As discussed briefly above, language is also found to play a central role in gendering the engineering field as masculine (Blosser, 2017, p. 36). There was a strong masculine culture (Du & Kolmos, 2007, p. 40) in the settings, particularly the use of coarse language and hostile ways of participating in discussions, as confirmed by Salima in earlier extracts and also in the extract below. Salima made use of a certain type of language (usually used by male students) to replicate, change and oppose the gendered borders of the engineering field and to gain acceptance into the engineering field illustrated by Salima:

*“...the language used by boys is quite different from that of girls – that’s what usually people say. But I also talk like these boys.”*

Salima’s discourse showed that the male students were receptive towards female students who behaved like them. The coarse language adopted by women or rough activities engaged in by women is also discussed by O’Dea, Lagisz, Jennions and Nakagawa (2018, p. 4), who argue that many women in STEM challenge gendered stereotypes and adopt manly behaviours to gain acceptance.

#### **5.4.3.1 Undoing hegemony: physically weak women - Nisha**

As already hinted in the earlier discussions, physically weak women were not easily accepted by the men in the engineering field, as men have the tendency to associate engineering with physical strength. As for Nisha, she appeared to be fragile as she was someone who was physically very slim and preferred to wear dresses and skirts, which are characterised as gendered symbolisations (Connell, 1996). One could describe her as being physically ‘tiny’. The idea that women are naturally weak and that they should remain in sheltered private domains portrays hegemonic masculinity. This image is supported by the complementary image of men as powerful and strong. Thus, the jobs that require bodily strength, specifically fieldwork, are argued to be masculine jobs, such as those in the field of engineering.

The male students saw Nisha’s physique as not appropriate to the field of engineering. According to the male students, a weak physique was not appropriate for engineering. Nisha reported:

*“Yes, they make me feel uncomfortable, unhappy and unwanted in class, for example once they told me that as I am very slim, it will be difficult for me to do field work... They used to make jokes on my physique - that I look like a primary*

*school pupil. I tried my best to ignore such comments and to concentrate on my studies...*”

The belief that engineering was not meant for women was depicted when the male peers told Nisha that she did not deserve to score the highest marks in an assignment. Those male students who associated engineering with strength were disconcerted by Nisha’s small physical frame, as shown in the vignette above when she scored high marks in an assessment as illustrated below:

*“...once I scored the highest marks an assignment; two boys told me that I did not deserve that. I presume that they think that I may be a threat to their achievement in their studies, as I could do better than them, that is why they told me that.”*

Nisha’s physique represented traditional stereotypes of women that portrayed women as passive, emotional, physically weak and helpless. According to Thébaud and Charles (2018, p. 8), women are presumed to be “warm, kind, nurturing, friendly, and polite”. Nisha’s discourse showed how young men and women were growing up in a society that attributed specific gender roles to men and women. Young men are encouraged to focus on “skilled professions, heroism, and expertise” whereas young women are encouraged to focus on “being domestic, caring for others, socializing, being amateurs, and appreciating and striving for beauty” (Reich, Black & Foliaki, 2018, p. 3). For instance, the traditional female role included appearance and beauty, interest in domestic skills and care. Such traditional female roles were often reinforced in educational institutions that carried social expectations for women with respect to their physical appearance and body image.

Emma had to negotiate the femininity of her physical frame with the male-dominated environment of engineering and she kept a balance between femininity and being a student in a male-dominated field (Du & Kolmos, 2007, p. 40). Emma’s attitude and practices portrayed liberal feminism, which emphasises the capability of women to preserve their femininity and equality through their actions and choices.

Involvement in science was labelled as being for those who are not physically and socially attractive, less creative and less socially competent and at the same time, more intelligent and motivated; students who like physics are perceived as unfeminine (Kessels, 2015, p. 282). However, such characteristics were not suited

for fieldwork in engineering that was perceived as linked to physical strength. Fieldwork, which forms part of the engineering curriculum, includes talking to masons and knowing the different types of materials used for construction, which is considered appropriate for men and not appropriate for women, as illustrated by Emma in the extract below:

*“... girls in a man's world - that is what the boys think by saying that on field work it will be difficult for me to talk to masons.”*

The stereotyped belief that engineering was not meant for women was depicted by Mia's discourse. For example, the stereotype belief that engineering required physical strength was shown towards Mia and that women were confined to physical look and caregiving as shown below:

*“Once a boy told me that girls should look pretty in their short dresses and be capable of taking care of the family later. I told him that girls can do everything. It gets me mad, but as long as I stick to it, I will show them women can do these jobs.”*

Fitting into an engineering field or adapting to the engineering field (Faulkner, 2009, p. 182) could require being comfortable in conversations about football, sexual humour or coarse language (Risman, Froyum & Scarborough, 2018, p. 371). The findings above revealed that female students needed to undermine their personality as 'real' women if they were to fit in the engineering field. By becoming invisible as women and by disqualifying their femininity, like Salima, women engineers who 'wear skirts' would not be taken seriously as Emma and Nisha, who could be characterised as 'girly types'. "Femininity is symbolised through women's concern with beautifying themselves" (Sasson-Levy, 2003, p. 452). Emma, Nisha and Mia portrayed gendered symbolisation by associating women with dresses, skirts, long hair amongst others, which was, as seen above, assessed by the male students as not belonging to the field of engineering.

#### **5.4.4 Differential treatment by academic teaching staff**

Through their gendered understanding of teaching engineering, academic teaching staff also shaped the learning experiences of the participants. While there was evidence that the practice was gendered, the effects on the nature of the learning experiences of participants were variously described and interpreted. Female academic teaching staff motivated the female students and were often seen as role

models by these students. Contrary to the expectations for women, men were expected to display courage, chivalry and honour (Crozier-De Rosa, 2018, p. 215). As in the literature, the findings were that male academic teaching staff demonstrated chivalry towards female students.

#### **5.4.4.1 Supportive academic teaching staff - Emma and Nisha**

Academic teaching staff are influential figures who have a main part in presenting students to the engineering profession and can influence students' experiences (Blosser, 2017, p. 24). Academic teaching staff often had a significant factor in informing students about engineering and its value in the society. Faculty care or lack thereof may be related to students' motivational attitudes, which drove them to learn (Siegel et al., 2016, p. 2). Male students may be much more likely to perceive care from their male instructors in a non-academic context than female students (Siegel et al., 2016, p. 4). Some male academic teaching staff were seen by the female students as believing that engineering was more appropriate for men than women, and they held a gender stereotype, generally in presenting engineers as men, but also in often offering additional support to female students that sometimes negatively impacted on their learning experiences (Yaşar et al., 2006, p. 212). The findings also show the creation of gendered cultures within the engineering field and how male academic teaching staff played a role in such gendered cultures. Male academic teaching staff were not only involved in the teaching process, but also, they interacted with students in ways that shaped the academic setting.

One of the techniques in which academic teaching staff intervened in the female students' studies was through affirmative support. Emma reported different forms of attention from the academic teaching staff – she experienced such attention when female students were being asked easy questions and she was being praised for her answer, which made her feel that she was rewarded publicly for her effort to answer and she was being compared favourably to her male peers. These forms of attention, which she notes as having benefitted from, built her confidence as she felt supported and experienced success:

*“The lecturers give additional support in class if asked for from both girls and boys for example, they usually come to me first, then go to the boys when a topic is not clear. They even take more notice of me than the boys when I need help.”*

*“In class the lecturer does not ask us too difficult questions. I find it enjoyable to see the boys not able to give correct answers. Sometimes I know the answers to the questions asked to the boys and I raise my hand to answer. When I gave the correct answer then the lecturer said to the boys, “you must learn from her”. I feel happy then. But the boys do not appreciate because they would reply back by saying “Sir, we will learn from you and books not from her”.*

Nurhadi, Salamah, Destari and Suseno (2018) argued that teachers in STEM provided additional support to the female students’ personal resilience in grasping STEM subjects. Preferential treatment by academic teaching staff created some jealousy and division between male and female students. This also led to the impression that grades earned by female students were not based on their ability but on some form of favouritism. The good grades earned by female students were often associated with such preference instead of hard work and intelligence, as mentioned by Emma:

*“By treating us like that, the lecturer does not realise that such situation creates division amongst boys and girls because afterwards in every conversation, the boys would say that “Girls can replace books now”.”*

Emma further added:

*“I do not appreciate when sometimes the boys say that girls are not earning their grades, lecturers favour girls, because I work very hard to earn good grades, sometimes better than the boys. It is all hard work.”*

When female students outperformed male students, male students believed that the achievement of the female students was the result of favouritism (Stetsenko, Little, Gordeeva, Grasshof & Oettingen, 2000, p. 517). When the achievement gap is more in favour of female students, the higher achievement gap is translated as a gendered preference in grades in favour of female students by the academic teaching staff (Terrier, 2020, p. 8). Male students found that “discrimination” was in favour of female students (Terrier, 2020, p. 16). Literature has shown that men have difficulties to accept the fact that women can be better than men in STEM. Women’s intelligence and hard work often lead to good grades and such a performance by women challenges masculinity in STEM.

Participants reported that they appreciated the caring attitude of female academic teaching staff, from whom they received genuine support, unlike the affirmative support from male academic teaching staff that undermined the female students and

is premised on the assumption that female students are not as intelligent as the male students. For example, Emma mentioned that she obtained additional support from one of her female academic teaching staff, as shown below:

*“She is still very caring and polite. Most of the students got an A in that module in the final year exam last year. Moreover, she never refuses to meet anyone of us in her office for additional support for an assignment or any other matter.”*

Emma reported that academic teaching staff were very helpful to students when additional support was being sought. However, she also mentioned that special attention was sometimes given to her when some academic teaching staff gave her more notice than the male students, by coming to her first when she had a query. Even though Emma felt supported, she felt that she was good enough and that she did not need such special favours. There were some male academic teaching staff amongst those who would prefer to provide additional support to female students before helping the male students, according to Emma. Academic teaching staff positioned female students in subordination to the male students and therefore they encouraged female students because according to them, women cannot beat men. However, whether the intended effect and the actual effect were the same was another matter.

Nisha’s learning experience conveyed that she experienced favouritism from male academic teaching staff, which she did not appreciate because she was a hard-working student. According to Nisha, equal treatment should be given to both male students and female students:

*“One lecturer once told a boy after the latter had asked him why do lecturers not shout at girls, then the latter replied “Oh, she is a girl, we can’t shout at girls, or swear at her, or hit her on the head. This is not polite... The boys did not like when girls got special treatment because they said, ‘so what if they are girls?’”*

Nisha was of the view that being studious and diligent were important qualities that every student should possess, and every academic teaching staff preferred students who were serious in their studies:

*“I always meet the deadlines for all my assignments and homework compared to some of the boys, so the lecturers are nicer to me. I do not want special treatment from the lecturers and this was never the case at secondary school also. I think that lecturers like students who are like I am, when they are respectful and hardworking, and engaged in a way where they are participating in class*

*discussions and giving others the opportunity to participate in class discussions as well.”*

*“Whenever I have a difficulty in a classwork, the lecturers would come along and do it for me. If it was one of the boys they would show them and say "now you do it". If he would have shown me how to do it, I would have done it on my own.”*

Moreover, Nisha also reported that:

*“Not all lecturers do that. Some would just explain the concept again so that we can solve the problem on our own. But others, would just give the solution. I don't know if they do that because they are too busy and don't have time to explain again. But with the boys, some lecturers encourage them to solve the problem on their own.”*

According to Lakoff (1973), men are taught to speak more politely with women than with other men. The way the male academic staff responded is consistent with the gender socialisation that these male academics received when growing up. Male academic teaching staff provided special attention to female students by giving them individual explanations and would show them how to find answers to a question, whereas the male students did not get the same attention. Male academic teaching staff appeared to assume that female students had a different code of behaviour applicable to them. The experiences described by participants revealed that male academic teaching staff calibrated their teaching approach and how they negotiated interpersonal relationships depending on gender. While they were reported as being less vigilant in the language they used with male students, a degree of restraint was applied and justified too when called upon to explain the differential treatment. In terms of making the concepts accessible, there appeared to be an underpinning understanding that instructions must be repeated for female students.

Male academic teaching staff were found to give additional support or favouritism to the female students in class and on fieldwork as demonstrated by Emma and Nisha. Academic teaching staff were frequently the first contact between new students and the field of engineering, and the way they were ‘helpful’ to the participants shows how their learning experiences were strongly influenced by prevailing gender regimes at the university. Emma’s and Nisha’s discourses showed that some male academic teaching staff adopted gender regimes related to power and authority and

this could be observed in practices such as the curriculum and instructions given to students.

#### 5.4.4.2 Hegemonic academic teaching staff – Olivia, Mia and Salima

According to the participants, fieldwork in engineering was an important aspect of the programme, where students were trained to carry out land surveys, engage in measurement work on land taking levels with a dumpy level/auto level or talk to masons. Students' enthusiasm and engagement in the activities increased during fieldwork (Rahmawati & Koul, 2016, p. 157). Male academic teaching staff mediated the transition to fieldwork differently for male and female students. This sought to position the world of engineering as a man's arena with a specific language, social code and authority embodied by the male figure.

Women knew that their gender enhanced their challenges of interacting with male peers and academic teaching staff who questioned their abilities (McPherson, 2017, p. 10). During fieldwork, the participants experienced special attention from the male academic teaching staff, as reported by Olivia, Mia and Salima. Both Olivia and Mia experienced gender-biased treatment – seeking to position engineering as not meant for women. For example, the male academic teaching staff would explain twice to the participants some technical aspects on fieldwork, whereas no second explanation would be given to the male students. Like Mia, Olivia experienced special treatment from the academic teaching staff which was advantageous for her during fieldwork. However, it culminated in some form of inequality between male students and female students:

*“On fieldwork, the lecturer would come round to me and ask me twice whether I was fine. Once, one of the boys asked for help from a lecturer that he wanted to know the difference between the different types of bricks used in construction and the latter told him that he just showed him how to do it. But when I asked the question to the lecturer, he showed me again”*

The male academic teaching staff sought to demonstrate care; however, this care was linked to masculinity and power. They projected the dominant images of masculinity - with chivalry being at the centre. Such discourses implicitly lead to the exclusion of women from the engineering field. The following extract from Mia's critical

individual conversation captured the presence of gender regimes in the engineering field at university:

*“The male lecturers are helpful, especially during fieldwork and for the dissertation and that differential treatment helped to understand better the technical parts.”*

The male academic teaching staff had the belief that Mia would not be able to deal with masons on fieldwork as shown below:

*“During fieldwork, the academic teaching staff asked the masons to avoid using foul language in front of me and to listen to what I say. My supervisor, who is a male academic teaching staff, is very supportive.”*

Emotionality and irrationality are projected onto children, who are feminised in their positioning as powerless (Davies, 1989) and this emotionality and irrationality is performed when they grow into adults. For example, this was also reflected in the ways in which female students were perceived as being less powerful than the male students when academic teaching staff considered female students as being less able and gave them more attention and care in order to ‘help’ them, as reported by Mia:

*“Last year, whenever a lecturer used to explain something quite technical, he used to look at me and ask whether I understood what he just explained. I did not like it because then the whole class would turn around to look at me. This made me feel uncomfortable and I wonder whether I should say yes or no to the lecturer. I wondered whether I should say yes so to get him off my back or if I say no, he will ask me complicated questions.”*

The above discourse showed that academic teaching staff treated female students as weaker than the male students, thus giving the female students additional attention and care.

According to Olivia, academic teaching staff seemed to assume that ideas of a technical nature would add more of a challenge for female students, as shown in the extract below:

*“When lecturers behave like that with girls, the boys think that girls are soft and boys do not like it when we, girls get special treatment.”*

Wood Jr (2020, p. 6) states that apparent differential treatment from teachers yields a negative effect on the academic achievement of a student. It appeared that the attention of the academic teaching staff emanating from a positive intention was not

always interpreted as help, since it made Olivia feel conscious of a perceived ‘disability’ or ‘difficulty’ that she might not experience.

Like Mia and Olivia, Salima also found that some male academic teaching staff did not treat male students and female students equally, which she reported as an observer rather than as a recipient. Salima’s discourse also shows how male academic teaching staff demonstrated their hegemonic masculinity in class towards their male students. This also drew on a traditional model of teaching where the teacher is associated with authority. Male academic teaching staff showed their power by retaining male students in the engineering major, as is clearly demonstrated below:

*“We also had one male lecturer who, would say stuff like, “Salima is doing this” or “the girls have nearly completed”, to make the boys get on with their work. I find his behaviour irritating because he is always comparing girls to boys and trying to use girls’ good work to encourage and motivate the boys. Such behaviours create gender awareness in class...I feel as if boys should work better than girls and that the lecturer wants boys to do better than girls.”*

This showed that male academic teaching staff helped Salima because she was a woman, which illustrated that they differentiated between male and female students.

While female academic teaching staff influenced the female students doing engineering positively, male academic teaching staff were also supportive in a gendered way. The general aspects of chivalry are often shown when men took the role of protector (pastoral care), which is related to machismo, such as not allowing women to do heavy work (Stobbe, 2005, p. 113). Under the mask of chivalry, some male academic teaching staff performed hegemonic masculinity and power, albeit it was presented as care.

#### **5.4.4.3 ‘Special’ academic teaching staff – Nisha, Olivia, Salima and Mia**

The male domination within engineering caused the female students who were in the minority to feel different and this difference made the female students feel insecure (Du & Kolmos, 2007, p. 40). While male academic teaching staff offered support in favour of female students to show their dominance of the engineering field over the female students, female academic teachings staff appeared to offer feminist and activist support to the female students. The caring of the female academic teaching

staff towards the participants increased the confidence of the female students by prioritising the engineering competencies in their minds, as stated by Nisha and Olivia. Nisha reported the following:

*“...because women understand girls better.”*

Some female students preferred to have other women around as support and motivation and to have some opportunities to talk about women’s issues (Du & Kolmos, 2007, p. 40). Olivia’s extract below also demonstrated women’s feelings when a female academic teaching staff taught a module:

*“But I feel more at ease and comfortable with a female lecturer.”*

Faculty-student interactions can have a powerful impact on learner engagement in the classroom (Siegel et al., 2016, p. 1). Salima’s learning experience with the academic teaching staff had shaped her future thoughts about the engineering field. Salima reported that some academic teaching staff were very supportive, as shown in the extract below, and that female students often appreciated the additional support, because of their beliefs that women requires discrimination in their favour:

*“The lecturers, who are mostly male, motivate and encourage the students.”*

*“Since Year 1, I find all the lecturers are very helpful. I find them sometimes more helpful towards other girls. Because in class I usually sit among the boys, so when the other girls have a problem, I notice that some male lecturers would give more attention to them...I remember one lecturer would keep explaining the concept to the girls by going to their desks and would spend some minutes at their desk explaining to them. And the girls would keep asking questions and the lecturer would answer.”*

*“There is a lecture taught by a male lecturer, in which I never yawn. His lectures are so interesting I often feel overwhelmed by the type of information he provides. He possesses a keen interest in his subject that he can answer any question a student asks.”*

A special relationship of friendship was reported with the female academic teaching staff, who were very motivating and caring. Women sometimes felt affirmed by this additional support. The approach adopted by female academic teaching staff, who had been engineering students themselves, was highly appreciated by Salima, whereas some male academic teaching staff motivated the male students by encouraging them to emulate female students’ higher academic performance. This

was a way to inform male students to be better than female students, implying that female students cannot outperform male students. This also shows how the gender regimes prevailing on the campus was additionally entrenched through the attitudes of male academic teaching staff. Salima expressed the view that the caring attitude that female academic teaching staff demonstrated towards the female students resulted from their struggle in the engineering field when they were students:

*“How can I forget to tell you about her - there is a female lecturer who I consider as the ideal teacher – she is very motivating by telling her own struggle in the civil engineering field as a student, and I can feel that she prefers girls to boys. She is always encouraging me to work harder and to score higher marks than the boys. This lady is very special to me...I respect her a lot and maybe I would like to be like her one day – intelligent, caring and so simple. Once I slipped on the stairs of the Engineering Tower, when she came to class and saw that I was in pain, she did not think twice to take me to the nearby clinic in her car and even paid for the doctor’s fee. I am thankful to her.”*

Zachmann (2018, p. 6) argued that a lack of female role models for female students in STEM can result in the understanding that STEM is not fit for the young women. Salima’s discourse showed that female academic teaching staff had an important role in the learning experience (and support) of female students in the engineering field. They acted as role models and encouraged and motivated the female students.

Salima reported that her voice could be heard by a female academic teaching staff, especially when she missed one of the class tests as shown below:

*“They are nice because once I was absent for class test because I was ill. After two days, when I came to class, I asked when whether I could do the test on another day. You know, she prepared a question paper only for me. And I did the test the day after.”*

Mia shared a special relationship with one member of the female academic teaching staff, whom she considered as her role model. Female students fostered safe spaces in the engineering environment with same-gender academic teaching staff that improved some of the discomforting aspects of their learning experience (Daniels, Grineski, Collins & Frederick, 2019). The female academic teaching staff member had a special influence on Mia’s learning experience:

*“Most of the lecturers whether male or female are OK. I have only two female lecturers this semester. I prefer the female lecturers to the male lecturers although the male lecturers are also good to me. I feel that the female lecturers understand girls better than male lecturers as have been also students like me.”*

Female students in STEM expressed contentment in relationships with academic teaching staff of the same gender (Daniels, Grineski, Collins & Frederick, 2019). According to some of the participants, the female academic teaching staff were more helpful to them compared to the male academic teaching staff, as experienced by Salima and Mia. Female academic teaching staff motivated the participants to break the stereotypes that people had with engineering as reported by Mia below:

*“I like her motivating words such as “It should never occur to you, girls that because you are a girl, you should not be choosing that civil engineering”. I am so thankful to her. Her encouragement has increased my confidence and I am determined to graduate with a first class.”*

According to Mia, it was also noted that female academic teaching staff understood female students better than the male academic teaching staff. The reason why the participants preferred female academic teaching staff to male academic teaching staff is shown by the extract below, when Mia reported about a female academic teaching staff:

*“She is so clear and precise while doing the lectures. Moreover, she knows how to make everybody participate in group discussions and she makes everybody likes the subject - I think she is a born teacher.”*

Mia attributed this to empowerment, self-determination and evocation of peer support (Ging & O’Higgins Norman, 2016, p. 3). A special relationship was established between the female academic teaching staff and the participant – there was mutual understanding between them as there was a time when the female academic teaching staff had been a student, so she could understand the feelings of being a student in this male-dominated field as shown below:

*“It actually made both of us even more competitive and more determined to prove ourselves and be better than the boys.”*

Gender role models were found to be important for making the first step towards studying fields such as engineering, as reported by Mia in the extract below:

*“I would prefer a female lecturer because the female lecturers are friendly and nice to girls...”*

It was found that most of the participants considered same-gender academic teaching staff as their role models who were helpful to them. Female role models assist to enhance the performance of female engineering students and their sense of belonging

in the engineering field (Drury, Siy & Cheryan, 2011, p. 265). Female role models have an important and persistent influence on young women's ambitions (Drury, Siy & Cheryan, 2011, p. 266). Hill, Corbett and St Rose (2010) found that giving women the opportunity to meet successful female role models could help to motivate them and help in eradicating the gendered beliefs they have about the field. The female academic teaching staff were role models for the female students as they represented success in engineering and, therefore, gave them confidence that their journey would also be successful.

Gendered stereotypes on women's qualities and skills are significant, and women feel the need for role models to succeed in STEM (Drury, Siy & Cheryan, 2011, p. 267). The findings of this study showed a relationship between the female students and perceived care of female academic teaching staff - as the level of active learning and teaching methods increased, students noted the care they received from the female academic teaching staff. A distinct difference in the sense of belonging was also developed between the female academic teaching staff and the female students.

All the participants were in a boys' club atmosphere, whether in class with the male peers and the male academic teaching staff or on fieldwork with building contractors, masons, engineers, male peers and male academic teaching staff. On fieldwork, male academic teaching staff initiated double standards and judgements about learning by participants, thus giving participants additional support and special treatment. Similarities were noted between the learning experiences that Emma, Nisha, Salima, Olivia and Mia had with the male academic teaching staff.

## 5.5 Chapter summary

The current chapter outlined the way in which the themes identified in the case studies were categorised as a means of refining and analysing the data. The case studies brought out the themes that were found to have emerged and that comprised the gender regimes in an educational context and influenced the learning experiences of the 5 participants. They shed light upon gender regimes and the related learning experiences. An analysis of these themes through a comparative approach followed. The findings drawn from this level of analysis revealed that the different aspects

identified did not act in isolation. Rather, they interacted with one another and impacted on the learning experiences of the female students. In the next chapter, Level 2 analysis is detailed and the 'operations of gender regimes in higher education institution' is theorised.

## **CHAPTER 6: UNMASKING GENDER REGIMES IN THE LEARNING EXPERIENCES OF FEMALE ENGINEERING STUDENTS IN HIGHER EDUCATION**

### **6.1 Introduction**

The case study analysis stage emphasised the significant learning experiences of the 5 participants and the gender regimes present in a higher education institution. The data generated was indeed rich with the essence of each participant's unique learning experiences. The first level of analysis was a significant step towards better understanding the phenomenon under study and towards the next level of analysis. Level 2 analysis is detailed in this chapter. This chapter also marked the climax of my study into the exploration of Connell's theory of gender relations (2002) proposed in my thesis: 'operations of gender regimes in higher education institution'. The findings highlighted the complex relationship between the present gender regimes in the studied institutional setting and the learning experiences of female engineering students. Following Connell's (2002) understanding of feminism, hegemonic masculinity and the patriarchal dividend were influencing the learning experiences of women through performative acts within the predominant discourses of power. Four dimensions of power that were evident from the findings are discussed in this chapter.

### **6.2 Structure of the chapter**

This chapter comprises two sections. Section 1 names the different themes that emerged during the process of case study analysis. The re-arrangement of the themes, which allowed a more consistent approach to data analysis, is then illustrated. It is followed by an in-depth thematic cross-case analysis.

In the section 2, the 'operations of gender regimes in higher education institution' is theorised, wherein the dimension of gender relations of power of Connell's theory of gender relations (2002) is explored in detail to show how this dimension informs gender regimes in a higher educational context.

### **6.3 Section 1: Bringing together the findings by thematic cross-case analysis**

The section constitutes the phases of data analysis and each phase is elaborated. The cross-case analysis focused on a process of discovering commonalities and differences about the findings of the five cases through the critical individual conversations. The theoretical framework guided the study to search for themes that emerged. The critical individual conversations of the five cases identified the most significant influences of gender regimes in the learning experiences of female engineering students and examined these in relation to the existing literature. The different themes that emerged during the process of the critical individual conversations of data production are analysed in this section. The section explains how the data was refined and reduced during a three-step process that included: (i) collating themes that belonged to the same category, (ii) classifying the themes into main themes, and (iii) a thematic cross-case analysis, where each theme is examined within each case.

Following the construction of the case studies, I engaged in their analysis. I opted for an inductive approach that involved the search for pattern from the findings and the development of explanations for those patterns. The inductive approach allowed the identification of the themes emerging from each case study, given that this study is based on the feminist paradigm and recognises the subjective and contextualised nature of experiences. I became conscious of the variety of the factors of gender regimes, which had an impact on the learning experiences of the participants. This understanding of inductive analysis is consistent with that of Mihas (2019) who describes inductive analysis as the process of finding appropriate topics to the data. The findings revealed that the themes had echoed across more than one case study and were therefore analysed across the five cases. This approach enabled me to comment on the extent to which and the way in which each factor that made up the gender regimes had an influence on each participant, thereby shaping their learning experiences.

The way in which each factor of gender regimes had an impact upon the participants' learning experiences are analysed and discussed in this chapter. To determine a deep understanding of the textured reality of the participants' learning experiences, this study included a cross-case analysis. Such an approach to data

analysis is supported by McAdams (2012, p. 17), who terms it “discovery research”. Connell’s theory of gender relations (2002) offered the means to structure the data generation processes.

By relying on the findings from the cross-case comparisons to the data generated from the participants from the five critical individual conversations, the themes were validated by the cross-case analysis and an understanding obtained from this section of the study was used to interpret the findings.

### **6.3.1 Influence of family – a male inspiration**

Family encouragement allows students’ educational success (Mishra, 2020). Support from family members is related to improved educational achievement among minority students (Elliott & Bachman, 2018). Parental involvement and interaction in STEM have significant influences on students’ engagement in and identification with STEM. Engaging in a conversation with family members about STEM and exposure to STEM media in childhood, have shown to increase interest in STEM in higher education (Dou, Hazari, Dabney, Sonnert & Sadler, 2019). Familial advocacy strengthens the aspiration of young women to enter STEM fields.

It could be noted that the families to which the participants belonged were yet another significant factor that influenced the learning experiences of female students. The participants scripted their biography by drawing inspiration from their families to enter this male-dominated world. The progressive attitude of parents towards STEM influences the performance of women in STEM (Kahn & Ginther, 2017, p. 12). Young women were motivated by their family to study STEM fields to reduce the inadequate educational situation of their mothers and probably to reduce the stereotypical gender roles of caregiving and housework associated with women (Sáinz & Müller, 2018, p. 11).

For many participants, family was found to be a source of inspiration, as many family members were identified as having broken the stereotypes that restricted the engineering field to men only. Both male and female students who have their father in a STEM career are more likely to do a STEM degree than other students (Oguzoglu & Ozbeklik, 2016, p. 10). According to Brenøe (2017, p. 2), a same sex

sibling increases women's possibility of studying a STEM field in higher education. The presence of families' anticipatory socialisation role in the choice of an engineering career in this study was depicted through:

- (i) Provision of sibling role models; and
- (ii) Family pressure to succeed through a career in engineering.

The provision of sibling role models and family pressure to succeed through a career in engineering concur with literature. Parents provided positive influence and support to their children to have a career in STEM regardless of the gender of their children (Lloyd, Gore, Holmes, Smith & Fray, 2018, p. 317). Careers in caregiving, which are female-stereotypic, and careers in STEM which, are male-stereotypic (Block, Croft & Schmader, 2018) were not applicable for the participants. The anticipatory socialisation enabled some of the participants to increase their familiarity about Fly University, the teaching content, the study arrangement and the predominance of the masculine culture in engineering, all of which made their transition process to the engineering major easier, as illustrated by Emma, Nisha, Salima and Mia.

### **6.3.2 Ruling and passive men**

"Hegemonic masculinity is a question of how particular groups of men inhabit positions of power and wealth, and how they legitimate and reproduce the social relationships that generate their dominance" (Carrigan, Connell & Lee, 1985, p. 592). The findings revealed that hegemonic masculinity formed part of the gender regimes at Fly University. Many male students demonstrated hegemonic masculinity on fieldwork, in class discussions, in group work and in casual conversations as reported by the participants. Gender socialisation issues also manifested through hegemonic masculinity, which portrayed female students as nurturers and caregivers, and male students as having the required skill for engineering. Gender socialisation theory contributes to the ideas of masculinity and the concept "hegemony", and thus explains the operation of domination and hegemonic masculinity. One characteristic of ruling class hegemonic masculinity is the belief that, as female students did not count in big numbers, they could be dealt with by joking patronage. For example, some male students commented on the performance of female students in

assessments as deemed to be less good than the male students or by associating good performance to favouritism.

Connell explored hegemonic masculinity in terms of three structures of gender relations, namely the relations of labour, power, and cathexis (emotional attachment) (Connell, 1996, pp. 161-162). Regarding labour relations, such patriarchal benefits contribute to men having higher salaries or easier access to education; these benefits are characterised by Connell as the “patriarchal dividend” (Connell, 1996, p. 163). In this study, the patriarchal dividend was particularly demonstrated when male students associated fieldwork with masculinity. In terms of power relations, men control the means of institutionalised power (Connell, 1996, p. 164). For example, power relations were reinforced when male students associated women with caregiving and men with being the “engineers”. It is important to adapt to the engineering cultures and expect rough language on engineering sites (Male, Gardner, Figueroa & Bennett, 2018). The structure of cathexis was characterised by male superiority and violence, particularly through coarse language towards the female students. According to Connell, the three main institutions that correspond to these structures of gender relations are the labour market, the state and the family, and “are examples of what Connell calls gender regimes”. Therefore, hegemonic masculinity was not only understood as a configuration of practice but it was “also seen as being institutionalised in large-scale gender regimes” (Connell, 1996, p. 164) at Fly University, that is, as a process that involves social structure and personal life.

The findings showed that some participants were significantly more obedient students than their male peers. They appeared to have embraced an image of themselves as more compliant than their male peers, in relation to the expectations of learning engineering. A few male students were dutiful, attentive in the classroom and focused only on their studies and were not interested in being friendly with female students. The hegemonic male students usually excluded these ‘shy’ male students from their peer group, as they did with some of the female students. Men are socialised to be autonomous and goal oriented (Ging & O’Higgins Norman, 2016, p. 2), thus contributing to their dominating characteristic. Some male students were dominating in class as they had the tendency to answer all the questions of the academic teaching staff. The first impression that participants had of their male peers

was that they were unfriendly and held pessimistic assumptions of the participants' engineering abilities. When female students expressed their knowledge about a topic in the classroom or during fieldwork, their male peers expressed their dissatisfaction. The relationship with the male peers led some female students to the adoption of some masculine traits. This was supported by Francis (2005), who suggests that in schools, young adults reproduce the social relations of male dominance over women. Butler (1993) also states that the performance of gender becomes the re-enactment of meanings already socially established. In relation to this study, gender socialisation had an important influence on gender regimes at Fly University and this was particularly depicted when male students had the beliefs that engineering is not appropriate for women. Gender socialisation has moulded men in such a way that they are unable to acknowledge that there is no reason why women cannot excel in engineering.

### **6.3.3 Influence of secondary schooling on students and reciprocity of stereotyping**

The findings revealed that, since their secondary schooling, the female students had been deeply familiar with core ideas in science, thus enabling them to enrol in the engineering major. Baker and Jones (1993, p. 92) stated that female students, who have fewer opportunities, may perceive STEM as less crucial for their future and are being informed of that by teachers, parents and friends. The findings showed the effect of female students who had attended single-sex schools on the gender regimes at Fly University, where such female students were motivated to succeed in engineering. The findings indicated that female students who attended a single-sex secondary school were more likely to perform better than male students in assessments than those who attended a co-educational secondary school. The effect may be due in small part to feminist attitudes produced in a single-sex school environment. Internal structures can shape several socialisation processes that may in turn shape performance (Baker & Jones, 1993, p. 92). Interestingly, most of the participants appeared to have less stereotyped attitudes towards women in engineering (Tambo, Munakandafa, Matswetu & Munodawafa, 2011, p. 3906). Some women have started to discover that with more and more women joining the engineering field, engineering fits their character and peculiarity (Verdín, Godwin, Kirn, Benson & Potvin, 2018, p. 13). It seemed to appear that those female students

who had attended a single-sex secondary school and who used to enjoy female companionship and girly chat were less inclined to hold stereotypical views of engineering as being more suited to men than to women.

The most striking aspect of the women, who attended co-educational school, was their lack of confidence in their teacher's view of their individual capabilities in mathematics (Tambo, Munakandafa, Matswetu & Munodawafa, 2011, p. 3912). Findings from this study concurred with the prevailing view from the literature that women attending single-sex schools apparently have higher self-perception in the area of STEM than their co-educational counterparts, although of course the current study was small scale and cannot be generalised. Many women change themselves to fit into the mould of engineering by negotiating their identity and by subscribing to the social rules of engineering that were established by and for men (Verdín, Godwin, Kirn, Benson & Potvin, 2018, p. 16). In this study, it was found that, whereas the female students from the single-sex schools were confident and full of admiration for their academic teaching staff, the women from the co-educational schools may have lacked confidence in their engineering ability, that might have led one of the participants in this category to adopt a masculine outfit in order to fit in. Two of the participants seemed to have adopted male norms, possibly to position themselves as being fit for the engineering field.

#### **6.3.4 Body image: gender stereotypes**

This section deals with the participants' experiences of a gendered stereotype in engineering. This stereotyping was primarily described by the body image of the participant and nature of engineering work. According to Champion and Furnham (1999), the female ideal is presented through advertising as being extremely thin. "For women, the ideal body is slim" (Grogan, 2016, p. 11). Such notion of the ideal body of womanhood was supported by the results of this study and would suggest that neither men nor women can escape the sociocultural norm of body image. The learning environment was demonstrably experienced by the female students as gendered and male-dominated. For example, one of the participants was being praised by male students for being physically strong and therefore, fit for engineering whereas another participant who was physically thin was considered to being fit only for caregiving. The female participants were in the uncomfortable

position of having to continually prove their suitability in relation to cultural understandings of masculinity and engineering as a predominantly masculine field. The stereotyped belief, affiliated with the cultural understanding that women were rarely accepted and respected in the field, was often related to the body image and strength of their male peers, which was perceived by those peers as an important asset needed to perform the work of an engineer.

### **6.3.5 Gendered role of academic teaching staff**

The gender stereotypes of associating women with caring and men with competence follow from the accepted gender roles (Clow, Ricciardelli, & Betray, 2015, p. 364). For example, in this study, academic teaching staff preferred to have male students leading class discussions and fieldwork, rather than female students. From the narratives of the participants, it seemed that male academic teaching staff believed that male students had certain characteristics that enabled them to be better suited for engineering, whereas female academic teaching staff helped female students to overcome the engineering stereotype.

#### **6.3.5.1 Female academic teaching staff – motivating and caring role model**

Having female academic teaching staff as role models in STEM, helps “girls to see that their own mentor is not an exception to the rule” (Stoeger, Heilemann, Debatin & Schirner, 2021, p. 155). According to Mouganie and Wang (2020, p. 19), gender stereotypes and ability beliefs can be reduced by the presence of female role models in STEM, particularly in a context where negative gender stereotypes “that men are better than women” in STEM are present. Leavey (2016) reports “women in STEM prefer to have women mentors”. The teaching practices of teachers together with their personal relationships influence the learning settings they generate (Watt, Carmichael & Callingham, 2017, p. 169). “Same-gender teachers have found positive effects on women” (Kahn & Ginther, 2017, p. 15). The female academic teaching staff played a positive role in the learning experiences of the participants, as they acted as motivators and encouraged female students to work hard in the engineering field. Female academic teaching staff gave better subjective assessments marks to female students than those given by male academic teaching staff to female students (Kahn & Ginther, 2017, p. 15). Female students appreciated the academic support and encouragement they had from their female academic teaching staff

(Siegel et al., 2016, p. 3). Female academic teaching staff protect female students by helping them to improve their performance and to persist in the field (Drury, Siy & Cheryan, 2011, p. 266). The findings of this study revealed that the female academic teaching staff worked as role models with the female students to enable accomplishment of women in the engineering field.

Female academic teaching staff had a powerful impact on the participants. The findings of this study suggested that female academic teaching staff had the potential to undermine the 'chilly climate' present in the engineering field and to provide a more positive normative atmosphere for women to learn. The participants also commented on the emotional support that they obtained from the presence of female academic teaching staff who offered themselves to the participants as role models and encouraged them towards succeeding in the engineering major.

#### **6.3.5.2 Male academic teaching staff - macho**

Martino (2008) discussed that "male primary teachers partake in hegemonic masculinised performances in order to present themselves as 'real men' and/or father figures carrying out 'men's work' ", to avoid being considered as feminine. Assigning specific gender roles to men and women has created stereotypes and these have supported the present allocation of role to men and women (Clow, Ricciardelli, & Betray, 2015, p. 365). In line with Clow, Ricciardelli and Betray (2015, p. 365), men and women who join fields usually led by the other gender may be regarded as unfit and face negative stereotypes, discrimination or favouritism. Thus, if male academic teaching staff associated one gender with a particular social role, due to the existing gendered division of labour within their social environment at Fly University, particularly in the Faculty of Engineering, female students were made to feel incompatible with engineering. The male academic teaching staff seemed to associate each gender with their own social role and they often saw female students as lacking the qualities and characteristics required for the engineering field.

Perceived gendered differential treatment by teachers to female students' presents threats to motivational beliefs related to mathematics (McKellar, Marchand, Diemer, Malanchuk & Eccles, 2019, p. 5). Most male academic teaching staff seemed to demonstrate power, hegemonic masculinity and patriarchy. The participants

described the attitudes of male academic teaching staff towards them as different from the attitudes towards their male peers, as they were given discriminatory treatment in class and in fieldwork, even when it was done with good intentions. Most participants stated that the additional attention and support that they received from male academic teaching staff in class and in fieldwork caused them to feel that they were singled out and made them uncomfortable in some way.

#### **6.4 Section 2: The ‘operations of gender regimes in higher education institution’**

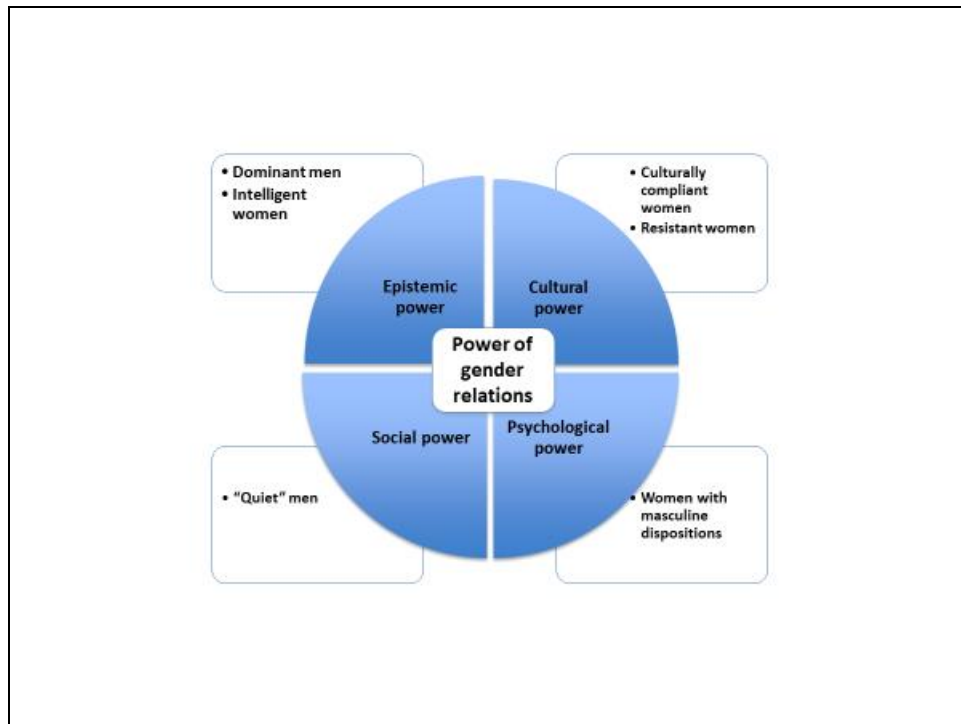
In chapter 2, I presented the theoretical framework that had guided me during data production. However, by attending to the critical individual conversations of the participants, I discovered that the inter-connections between gender division of labour, gender relations of power, emotion and human relations and gender culture and symbolism are diverse and complex; Connell (2002) argues that all the four dimensions are connected. An institutional culture is a group of norms, history and ways of doing things that form the implicit rules (Daly, 2005, p. 66); in this case, those related to gender are called gender regimes. However, the complexity of gender regimes in a higher educational context could be argued through the concept of ‘intersectionality’, that is, discrimination and oppression that limit individuals to act and placing them in a kind of institutional puzzle that cannot be solved (Crenshaw, 1989). Combining intersectionality with Connell’s hegemonic masculinity and patriarchal dividend, the complexity of gender regimes in higher education was unpacked.

My discussion so far had identified the themes that I believed were central and key to “the historically produced state of play in gender relations” (Connell, 1994, p. 151) in a higher education institution in Mauritius. In this section of theorising gender regimes, I had crystallised my theoretical contribution in understanding the gender regimes in the higher education context in Mauritius. By using Connell’s theory of gender relations (2002), the first core gender pattern was brought into view; that is, the continuity of hegemonic masculinity and patriarchy through the notion of power.

Conventional beliefs refer to expectations concerning suitable behaviour within a community and provide functions that enable social coordination (Yariv, 2009, p. 93). Women's presence amongst men and their degree of economic independence are important factors within gender regimes. Due to the influence of the Asian socio-cultural values in Mauritian society, the subordination of women is prevalent.

The 'operations of gender regimes in higher education institution' is an exploration of Connell's theory of gender relations (2002) particularly wherein the dimensions of gender relations of power are analysed. As elaborated and discussed in section 1 of this chapter, the theory of gender relations of power, applied to a higher educational context, helps in exploring the gendered processes that reinforce the disparities between men and women and the intersecting power relations within which gender is created (Bee, 2016, p. 8). Gender relations of power comprise the following four dimensions as illustrated in Figure 4:

- (i) Epistemic power
- (ii) Cultural power
- (iii) Psychological power
- (iv) Social power



**Figure 4: Operations of gender regimes in higher education institution**

What emerges from the findings is that specific masculinities and femininities were constructed in relation to each other. Butler (1990, p. 160), for instance, sees sex and gender as distinct categories, which are not imaginary but always derive from standards and norms. Further, she understood gender not as natural to men (masculine) and women (feminine) but as “performative” (Butler, 1990, p. 179). These constructions will be discussed below, with an elaboration of how they were performed within dominant discourses in the sections that follow.

Gender regimes influence the allocation of power by strengthening and depending on gender roles. The set of gender roles, qualities and attitudes that a context allocates to men and women is the effect of power relations as revealed through the learning experiences of the participants. The interplay of structural and interactional practices is discussed to explain the position of female students in an engineering major. This was depicted by four dimensions of power, as follows.

#### **6.4.1 Epistemic power**

The literature suggests that gender is the performative accomplishments of specific articulations of space (Butler, 1990, p. 34). Within the learning spaces of the engineering major and the interactions between the participants and their male peers, the qualities that were evident amongst the male peers, judging from the learning experiences of the participants, were those of hegemonic masculinity. This social construction allocates the female gender a dependent position and the male gender is allocated a dominant position (Meena, 2018, p. 45). The construction of hegemonic masculinity will now be discussed in the context of the performance of gender and gender regimes in the learning spaces of an engineering major.

##### **6.4.1.1 Dominant men**

Hegemonic masculinity was introduced to describe the perseverance of male authority (Duncanson, 2015, p. 2). Connell (1995, pp. 79-82) suggests that most men support hegemonic masculinity because, from it, they develop a patriarchal understanding “that ensures men’s collective power and privilege over women”. In this study, hegemonic masculinity was persistent, authoritative and assertive, especially in class. Attempting to perform hegemonic masculinity was a way by

which women could gain reasonable status as men and recognition from their peers (Coles, 2008, p. 237). The sexist and stereotypical behaviours of the male students also added to the chilly climate that female students experienced in the academic environment (Khan, Khan, Ali & Bilal, 2019, p. 159). As the embodiment of the dominant male, most of the male peers who constructed this type of masculinity were portrayed as strong and intelligent domineering men who determined the agenda for the female students. The dominant male students also mediated gendered language and asserted dominance within class discussions and fieldwork as they performed their masculinity to intimidate female students. Class discussion, according to some participants, was a male driven practice, as the female students did not join class discussions, fearing that they may be ridiculed. Most of the female students were attentive in class and did not have the opportunity to participate in class discussions while male students dominated the discussions; this demonstrates the presence of hegemonic masculinity and patriarchy in classrooms. From the findings, the participants reported that most of the male students positioned themselves as compliant students towards academic teaching staff. The male students were marked by their domineering attitude towards the female students where these male students were deliberately uncooperative as students, especially during class discussions.

#### **6.4.1.2 Intelligent women?**

In this study, some female students demonstrated a “deceptive compliance” to the male students but they reclaimed pride and power when they scored high marks in the assignments/examinations. The female students were taunted for excelling in their assessments, rather than being appreciated by their male peers for working hard in engineering. The male peers often downgraded their female rivals by attributing their high marks to preferential treatment based on gendered treatment by male academic teaching staff. Such teasing led to the objectification of the participants. However, the findings also suggest that the struggle which female students experienced with the class discussions and fieldwork and their perceived powerlessness led to the construction of a resistant femininity.

For these resistant female students, learning became a struggle. The findings suggest that hegemonic masculinity was manifested in the use of crudeness in the language

used and undesirable jokes made by some male students. These were demonstrations of the gender relations of power (Connell, 2002). From the learning experiences of the participants, the findings revealed that the male peers repeatedly expressed their frustration when the female students scored high marks in an assessment, through their offensive and sexist language.

#### **6.4.2 Cultural power**

Powerfully, the engineering field was culturally shaped as being masculine (Blosser, 2017, p. 28). Gender stereotypes that highlighted physical fitness for the engineering field were often reinforced. The learning experiences of the participants showed that female students had to demonstrate strength, resilience and fitness for the engineering environment. The findings also showed that male students demonstrated the ability to blend in the professional spaces of engineering better than female students.

##### **6.4.2.1 Culturally compliant women**

The subordinate role that participants often performed, as shown by the findings, was that of quiet compliance where some of the female students cooperated and offered no resistance. Women are found to be good compliant students (Radovic, Black, Salas & Williams, 2017, p. 456). They noted that the male peers persistently made a distinction between ‘the fit for engineering female students and the not fit for engineering female students’, with the male students finding the ‘not fit for engineering female students’ as caregivers - some male peers reminded some participants that the role of women is to look after the family. In this study, some of the participants were considered by the dominant male students as being not fit for the engineering field because these female students expressed their femininity. The form of femininity shown through the findings was often portrayed as being “fragile” physically, wearing dresses, having long hair and being in the girls’ group. As noted above, the reproduction of this form of femininity was sometimes performed as a mixture of compliance, cooperation and submission towards the male students, as some of the participants performed cultural compliance through the festival ‘Raksha Bandhan’ where their male peers are given the role of a protector to the female students. This cultural compliance created a persistent superiority of masculinity in favour of the male students.

#### **6.4.2.2 Resistant women**

Emotions and human relations as well as gender culture and symbolism of gender relations (Connell, 2002) were constantly negotiated by the participants. Those who were powerless in one instance became powerful in another. This was evident when some of the female students used their girls' group to move from a seemingly powerless position to a position of power, rather than become passive victims by working better than male students academically.

Some female students in this study positioned themselves in relation to the hegemonic masculinity as they performed their 'resistant femininity'. The specific nature of this hegemonic masculinity is described in the literature that suggests that western science is linked with the mental ability and power of men (Letts, 2001). The male students exerted their gender culture and symbolism of the engineering field over the female students through their discourses and their ways of relating to female students. The female students had to learn engineering through wilfully resisting and being defiant to the male students. Here, femininity was performed in resistance to the hegemonic masculinity and patriarchy by remaining in the girls' group. Those female students challenged ideological notions of traditional femininity and they were therefore resistant to conventional thinking about gender and STEM.

#### **6.4.3 Psychological power**

Some participants believed that female engineers are successful because they exhibit male characteristics. They attributed success in engineering to a renunciation of femininity, as implied by the data from the participants. Some of the participants 'transformed' their femininity, which was altered through a process of assimilation to fit the engineering field. This process of assimilation is a psychological instrument, which is covertly exercised for those who seek acceptance to the boys' group (restrictive membership or selective membership) by stripping off their female identity through dress, language and activities. Psychologically, such female students felt that they belonged to the engineering field and this reveals that their entry into the engineering field comes at a cost.

#### **6.4.3.1 Women with masculine dispositions**

The relationship with their male peers led some participants to adopt masculine performance and to erase their feminine identity. According to Koenig, Eagly, Mitchell and Ristikari (2011, p. 620), women who reduce their feminine traits, take part in gendered practices, undertake assertive and authoritative positions, their masculine qualities become an essential property. In this study, some female students went a long way to project themselves as masculine female students to gain acceptance in the male group, which was the symbol of dominance. Being part of the male group meant having access to networks. According to Bagilhole (2005, p. 113), women are not excluded in a male-dominated field when men in such a field form strong networks with these women. In this study, one of these female students, who spent most of her time playing football and wandering around with the male students, was easily accepted in the boys' group. The male students acknowledged that such female students were made for the engineering field, which they linked to body image and the nature of work of the engineering field. Besides taking the classroom as their territory, the male students had demarcated areas within which they performed their masculinity, such as fieldwork/industrial placement. Hence, there were patterns of relationship, hierarchy, dominance and power that were articulated in a space where, subtly and insidiously, male students assert their 'maleness' over the field by indifference. For most of the male students, the body image of the female students became a significant barrier to the engineering field. The findings showed that most of the female participants reported that according to the male peers, women who attempted assimilation were perceived as physically fit for engineering. Connell (1995, p. 18) states that, in opposition to femininities, hegemonic masculinities act to undermine the power of women, such as preventing female students from operating.

#### **6.4.4 Social power**

The male peers demonstrated their social power by taking the lead during group work and in class discussions, to the extent of excluding female students from discourses that enable knowledge. The socialisation process of gender shapes the design of the curriculum (Meena, 2018, p. 45). Most of the female students entered the engineering field with the expectations of family and the hope of attaining rational individuality as students and engineers in the future behind them. According

to the findings, the female students were optimistic of their field and hence they desired for education. Moreover, most of the female students were connected to engineering in ways that were connected to their lives, by which they felt encouraged. Therefore, they desired for education that would lead to success in the engineering field. Their fascination with the engineering field also contributed to this desire and they yearned to be successful in it.

In this study, most female students were optimistic of achieving such success. However, they entered a field that frequently reminded them of their gender. Female students demonstrated women's complicit attitudes when they performed roles in ways that suited male expectations (Steele & Ambady, 2006, p. 434). The findings showed that interactions between the students led to the construction of masculine women versus feminine women; compliant women versus resistant women and fit for engineering women versus not fit for engineering women. In performance of the traditional masculinity, most of the male peers maintained their power and control over the female students through emphasis on their gender. In this study, most of the female and male students were thus reproducing traditional forms of femininity.

#### **6.4.4.1 "Quiet" men**

Some men did not engage in any form of dominance towards the participants, thus revealing the diversity of masculinities. In the construction of this subordinate masculinity, these male students engaged in performances of compliance with the dominant male students; they failed to get involved in class discussions or join the other male students in their dominant performance. In this way, their quiet compliance was a way of resistance to the aggressive and hegemonic masculinity. There are certain masculinities that are subordinated by the hegemonic practice and their situations are no different from those of the subordination of women to men (Carrigan, Connell & Lee, 1985, p. 587). Hegemonic masculinity produces power "not only over women but also over subordinate masculinities" (Connell, 1987, pp. 186-188). The emotions displayed by these men portrayed emotions that typified those men in Connell's theory of gender relations (2002) who did not participate in an expression of the hegemonic masculinity but rather performed a subordinated masculinity and stayed away from the women. In choosing not to perform a gendered agenda in their role and relationship, they exhibited non-compliance to

hegemonic masculinity. Such type of performance also forms part of a type of gender regime in which men do not associate themselves or socialise with women.

## **6.5 Chapter summary**

The current chapter outlined the way in which the themes identified in the case studies were categorised as a means of analysing the data. The findings drawn from analysis revealed that the different aspects identified did not act in isolation. Rather, they interacted with one another and impacted on the learning experiences of the female engineering students. The findings led to the presentation of the ‘operations of gender regimes in higher education institution’. The answers to the research questions and my contribution to knowledge more generally are presented in the next chapter.

## **CHAPTER 7: DEVELOPING THE THESIS: CHALLENGING MASCULINITIES, POWER AND GENDER REGIMES**

### **7.1 Introduction**

The questions that were raised at the beginning of my study drove the way I interpreted the data. I was fascinated to explore how gender regimes influence the learning experiences of students, particularly of female students doing engineering in higher education. The main goal was to provide understanding on why the gender regimes influence the learning experiences of female engineering students in the way they do. Understandings obtained from the answers to the research questions of the study were used to draw the initial conclusions.

### **7.2 Structure of the chapter**

The current chapter constitutes four sections. In the first section, answers to the research questions are provided.

Section 2 brings out the contributions and implications of the study on theory and on policy.

Section 3 elaborates on the limitations of the study.

Finally, the fourth section advances from the findings to propose future avenues for new research.

### **7.3 Section 1: Finding answers to research questions**

The cross-case analysis has strengthened the understanding of the themes and the findings that emerged from the initial levels of analysis, namely the influences of gender regimes that operate in a higher education institution. In particular, the focus was on the learning experiences of female engineering students: relationship with male peers, academic teaching staff and curriculum. The aim was to explore the prevalent gender regimes in a higher education institution setting and how these regimes interact with the areas presented. The data analysis carried out, namely the thematic analysis and cross-case comparisons; brought answers to the first two research questions.

### 7.3.1 Answering research question 1

#### **Research question 1: What types of gender regimes are present in the learning experiences of female engineering students in a higher education institution located in Mauritius?**

With respect to the research question 1, the study has revealed an array of dimensions of gender regimes existing in a higher education institution, which influenced the learning experiences of students. The study was guided by Connell's theory of gender relations (2002), which comprises the four main dimensions of gender, namely gender division of labour, gender relations of power, emotion and human relations, and gender culture and symbolism. The findings on the learning experiences of the participants not only reflected what was found in the literature but also extended beyond what was already known.

#### 7.3.1.1 Disparity in academic teaching staff

As noted earlier, 19% of the academic teaching staff teaching on the BEng (Hons) Civil Engineering at Fly University where the research was conducted, were women. This figure was inconsistent with other faculties where generally there were more female academic teaching staff. This number indicates that even systemically the gender disparity in terms of staff recruitment reflects a structural manifestation of a gender regime that seeks to position women in a lower social position. From the experiences of participants and from documents (reports on higher education, university brochure, university programme documents, university policy documents, national policy documents and legislative acts) analysed, it can be seen that there was a gender disparity in the recruitment of academic teaching staff in the field of engineering. Gender regimes appear to manifest at Fly University through practices that effectively enabled the engineering field to remain predominantly male.

#### 7.3.1.2 Gender relations of power

One unexpected outcome of the low number of female academic teaching staff appears to be that it produced a sense of solidarity among participants and female academic teaching staff. As revealed by the findings, there is an acute awareness in terms of both discourse and practices that the situation needs to be contested by achieving a persistently high performance of female students in their studies, which

puts additional pressure on the participants to succeed at “beating the boys”. According to gender socialisation theory, which addresses the choices and constraints influenced by social norms and socialising agencies such as home, school and peer groups (McQuillan & d’Haenens, 2009, p. 1), women seem to be less capable than men in STEM fields. However, by equating themselves with or even by scoring higher marks than their male peers academically, the female students have proved to have the same intellectual capacity as their male peers. In line with liberal feminism, which emphasises the sameness of the genders, women can be considered as being as capable as men in any field.

The findings revealed that there is a gendered hierarchy within the micro community of the classroom in terms of the relationship between students and academic teaching staff. For example, female students often find themselves excluded in class discussions when male students and male academic teaching staff are involved in the discussions. Such type of gendered hierarchy can be understood through the theories of gender socialisation and hegemonic masculinity; female students are excluded from technical engineering discussions because the belief is that women will not be able to bring any contribution to such discussions. Further, the study revealed subterranean micro communities within which gender is performed. The organisational hierarchy that was present in the learning experiences of the participants reflected how the curriculum and its apparent immutability mediated relations of power at two levels: firstly, it structured relations of power between students and academic teaching staff. Secondly, it created spaces for male dominance to be enacted. One such telling example was how participants interpreted assistance from male peers as a demonstration of control and leadership rather than an effort to assist their learning. The leadership of male peers over the curriculum influenced the way inclusion or the lack of inclusion was experienced as the curriculum tacitly embraced logic of directed pedagogy that reveals a limited reading of what constitutes gender sensitive behaviour. The curriculum could integrate accounts of successful women engineers in the form of case studies.

The gendered teaching acts of academic teaching staff suggested the need for a gender-neutral teaching approach as female students were often considered as vulnerable. Such gendered acts that were adopted by academic teaching staff were

also experienced as a lack of trust in the capability, adaptability, and resilience of female students to be efficient without some assistance. The example of the male academic teaching staff twice repeating the same instructions to female students, because, presumably, the female students are slower to comprehend than the male students, epitomises this deficient view of female students. In relation to gender, some teachers may seem have a more positive attitude towards female students than towards male students in STEM as female students are more compliant than male students (Lietaert, Roorda, Laevers, Verschueren & De Fraine, 2015, p. 503). This deficient view of female students was culturally legitimised by the way male academic teaching staff behaved with the female engineering students. They sometimes even ‘favoured’ the female engineering students by giving them special treatment, which could be considered as a form of counterproductive positive discrimination against the female students or even an assumption that some female students are not fit for engineering and they need help.

One notable outcome of this study was how dominance was perceived and enacted by participants in various spaces. Compliance and dominance did not reside in individuals but were situationally enacted. While some aspects of the experiences were construed as being compliant and submissive, agentic power was reclaimed in another domain as illustrated powerfully in how female participants contested male power through high achievement on assessment tasks. When women are surrounded by women in engineering, they are motivated and stay in the field (Dasgupta, Scircle & Hunsinger, 2015, p. 4988). Equally through the act of keeping to the girls’ group and by being resistant to the male students, some female students legitimised the existence of a girls’ group and that it was possible to “beat the boys” by belonging to the girls’ group. Cooperation and reciprocity amongst female and male students existed in the learning experiences of some of the participants particularly during group work. During group assignments and presentations, both the female and male students worked as a team to score high marks. This collaboration, though, was perfunctory within the context of a task to be completed, rather than a deliberate choice to integrate women in the learning process.

Another aspect depicting gender relations of power is the encouragement that the female students received from the female teaching academic staff. In this case, the

female academic teaching staff made usage of their power to praise and encourage the female engineering students to work hard in the engineering field and to work even better than their male peers. While there could be some educational value in urging female students along, the strategy of academic teaching staff appear to work in favour of an “us and them” situation that did not challenge existing patterns of gendered relationship but rather appeared to have perpetuated them.

#### **7.3.1.3 Emotion and human relations**

The literature revealed that the presence of more female academic teaching staff could increase the number of female students and enrich the experiences of female students (Blosser, 2017, p. 37). In addition, when women have no women role models on fieldwork and do not assume technical roles, they are deprived of opportunities to put into practice their knowledge (Meadows & Sekaquaptewa, 2013, p. 13; Olsson & Martiny, 2018). The findings of this study concurred with such literature. Female academic teaching staff shared a special relationship or friendship with the female students, as they had been students themselves. The female academic teaching staff encouraged the female students to be dutiful – female students in the field of engineering who were inspired when the female academic teaching staff cared for and motivated them. Educators can provide positive role models (Master & Meltzoff, 2016, p. 228). The few female academic teaching staff were very much appreciated by the female students as they motivated female students to consider a profession in engineering and demonstrate how rewarding it was as a ‘genderless’ career. The female academic teaching staff encouraged female students to follow in their footsteps. The significance of emotions and human relations was demonstrated through the learning experiences of the participants when they experienced attachment with the female academic teaching staff who happened once to be in the same situation as the participants. The female academic teaching staff were also considerate towards the female students; this is consistent with gender socialisation theory, in which women are made to be caring. Thus, a special relationship was built between female students and female academic teaching staff which appeared to have worked against the vagaries of a male-driven learning context.

Mixed gender groups of around five students were formed for assignment and

PowerPoint presentations. Boundary crossing occurred with the marginalised group only for specific purposes; for example, it was noted that during fieldwork, group work or assignments, a group of students comprising both male and female students worked as a team, irrespective of their gender. This corresponds to liberal feminism, which emphasises the power of an individual to change discriminatory practices against women. Women had to work in solidarity with men and women had to enter the field of engineering on men's terms, thus perpetuating the existence of hegemonic masculinity.

#### **7.3.1.4 Gender culture and symbolism**

Gender culture and symbolism was revealed through a range of practices occurring both within and outside the perimeter of the university. This dimension was also repeated during industrial training when male peers defined the female gender identity as being not fit for engineering, which required a lot of physical strength. The connection of fieldwork to a man's job was associated with the requirement of physical strength.

The female engineering students were being helped by their male peers precisely because of the stereotyped understanding of engineering work as a man's terrain. As elaborated above, the four dimensions of Connell's theory of gender relations (2002) were found in the relationship between the male and female engineering students, the relations of the participants with the academic teaching staff and in the curriculum of the engineering major. The gender order, behaviours and practices all operate together to constitute gender regimes in educational contexts: classroom, on-site industrial training, practical and on campus. The power in the gender order creates unequal opportunities between men and women and the patriarchal inheritance of wealth and organisational control of men over women (Connell, 2009). This power in the gender order would create dependence of women on men, for example, during class discussions, female students were acting as passive learners by sitting quietly and listening to their male peers. The privileged behaviours of men and women frequently stayed unseen, as are patriarchal social norms that strengthen the gender regimes (Case, 2007; Coston and Kimmel, 2010; McIntosh, 2012). As far as practices in an educational context are concerned, they reinforce and support gendered social norms and the hegemonic social representations of gender that

altogether create gender regimes. Although experiences are specific for each participant, gender regimes play an important role (whether good or bad) in determining the type and nature of learning experiences of female engineering students in an educational context.

### **7.3.2 Answering research question 2**

#### **Research question 2: In what ways do these gender regimes shape the learning experiences of female engineering students in the selected institution?**

Regarding the research question 2, the study clearly brought out the range of learning experiences of the female engineering students. I deal here with the processes through which the four above-mentioned dimensions of gender regimes influenced the learning experiences in terms of the knowledge, skills and dispositions they developed. These dimensions of gender regimes influenced the ways in which curriculum and relationships were constructed and enacted. As the methodology was not aimed at producing the direct links between specific aspects of gender regimes and aspects of learning experiences, I propose a more profound analysis of how the institutional gender regimes had positive and negative influences on learning experiences.

##### **7.3.2.1 Influence of academic teaching staff on learning experience**

The previous section indicated that the gender disparity in terms of both female academic teaching staff and female students produced a form of gendered trust between these two categories of women, who shared stories of their own experiences and shared similarities. Female academic teaching staff represented the knowledge and skills required for success in engineering education that was accessible to any learner, irrespective of gender. The female academic teaching staff also legitimised a discourse that anyone who makes the right effort could achieve success. By walking their talk, female academic teaching staff created a climate of possibilities for success and worked towards engaging female students in a successful career. The influences of the female academic teaching staff on female students were not only symbolic as they taught in ways that made concepts accessible to female students and offered a cognitive and emotional support system to encourage retention, resilience and success. According to Almutawa (2005, p. 83), female academic teaching staff seem to provide more effective support to female students, with regard

to gender roles, than do male academic teaching staff. Female academic teaching staff act as role models who can reduce the consequences of and overcome negative stereotypes (Master, Cheryan & Meltzoff, 2014, p. 81). The same was found in this study. Female academic teaching staff provided greater benefits to female students than did male academic teaching staff in this male-dominated field and helped in closing the gender gap in STEM.

The pedagogical approach of male academic teaching staff often resulted in academic teaching staff, who were mostly male, giving additional explanation on how to solve problems to female students. This can be interpreted as a crisis of confidence in female students' ability to respond successfully to the given task. On the face of it, this can be read as support, but, in terms of how male students were trusted and allowed the opportunity to solve problems on their own, the behaviour of academic teaching staff would indicate that female students were not accorded the same pedagogical trust. The lack of pedagogical trust results from beliefs when assumed by academic teaching staff that might increase the harmful effects of STEM being considered as a male field and thus lead to a larger gender gap in STEM (Heyder, Steinmayr & Kessels, 2019, p. 4). Such directed teaching which aimed at female students in an engineering class, may work against long-term autonomy and encourage dependence. The attitude of male academic teaching staff towards female students is what one would expect from gender social theory, in that male academic teaching staff seem to believe that female students are less capable than male students and thus female students do not have the capability to solve engineering problems on their own and need help whereas male students do not need any additional help.

The learning experiences of the participants revealed that an engineering major was an institutionally prestigious subject, creating an environment where the academic teaching staff, who were mostly men in the Faculty of Engineering at Fly University, had authority and power. This meant that academic teaching staff exercised full control on all pedagogical decisions for students. Even though most of the male students engaged in a masculinity that was dominant and the female students performed a femininity that was sometimes resistant, both male and female students complied with the authority of the academic teaching staff.

The teaching methods adopted by the academic teaching staff were mainly traditional and teacher centred. In most lectures, activities such as oral presentations by students, group work, assignments and class discussions were constructed to enable students to master a specific body of knowledge. Teachers can create classroom-wide groups to make everyone feel included (Master & Meltzoff, 2016, p. 225). The findings showed that, in class discussions, it was challenging for the female students to make their voices heard amongst the male students and this captures hegemonic masculinity. Such teaching methods projected hegemonic masculinity associated with power and patriarchy. Thus, this highlights the ways that the patriarchal discourse of STEM is inculcated into classroom spaces.

The findings showed that male academic teaching staff practised special forms of interaction with the female students. The same type of special attention was witnessed by the female students in fieldwork, where the male academic teaching staff gave attention to the conversation between masons and female students. However, the learning experiences of the participants also revealed that some male academic teaching staff preferred female students to male students, as female students were hard-working students and did their assignments and homework on time by meeting the deadline. This shows that some male academic teaching staff acknowledged the intellectual abilities of women and that women are as efficient as men in engineering. Of course, this is not to discard the point that while support was affirmative, it still nevertheless served to advance patriarchy, often creating an image of women as needing additional attention.

#### **7.3.2.2 Influence of curriculum on learning experience**

The curriculum was not gender inclusive, because of its focus on theory and abstraction. The experiences of participants showed that men's greatest ways of succeeding were often in the theory rich areas of the curriculum. It showed that female students believe that their male peers were more comfortable with certain aspects of the curriculum than they were. The concept of 'internalised subordination' was depicted by female students who were under-privileged and who saw themselves as victims to the curriculum (Adams, Blumenfeld, Castaneda, Hackman, Peters & Zuniga, 2000, p. 12). This shows that women who have limited power often

accept stereotypes about their social groups (Adams, Bell & Griffffin, 1997, p. 21). The teaching approaches and methods appeared to have comforted female students in their understanding that the compliance learned as students could be transferred from secondary schools to university and produce the same outcomes. How far these are useful qualities in the world of engineering is another matter.

The didactic pedagogy of the curriculum allowed little space for individual attention. The group discussions that constituted the “innovation” were not structured and monitored to allow everybody to participate, and in fact created another space for male dominance to perpetuate. Many attempts from some male academic teaching staff to give voice to female students were derided when some of the male academic teaching staff tried to stop male students during class discussions from giving the opportunity to female students to participate, and thus classroom discussions were also exclusionary. In fact, this is where the gender regime of the institution became more evident: even timid attempts to break male dominance were trumped by deeply ingrained stereotypes of males that dominated the oral space. Within the engineering cultures, there are sub-cultures, some of which have developed into hegemonic masculinities, and these masculinities are related to power, patriarchy and the control of dominant men (Rap & Oré, 2017, pp. 3-4). As part of the engineering cultures, hegemonic masculinity was performed in classrooms towards female students.

#### **7.3.2.3 Influence of male peers on learning experience**

The experience of collaboration was lived only with a specific group of male students who did not espouse the gendered/male-dominated perspective. This specific group of male peers co-operated with the participants during group assignments and presentations and was supportive for academic purposes. The power of the curriculum, including teaching methods, also contributed to the construction of masculinities and femininities. In addition to experiencing their femininity as an incursion to the engineering field, the female students also found a dearth of real-life examples in textbooks. The curriculum reproduced gender relations of power (Connell, 2002), where the students had to adhere to what was offered to them as pedagogy, content, assessment, and field-based work. The curriculum carries with it the surprising but “significant residues of inequities” that give rise to “questions among women about whether they can or want to “fit” into this culture” (Seron,

Silbey, Cech & Rubineau, 2016, p. 3). Elsewhere, there are engineering programmes that have instead placed emphasis on design and collaborative learning in the classroom, in principle simulating and demonstrating the worksite to improve women's persistence in the field (Seron, Silbey, Cech & Rubineau, 2016, p. 20). Laboratory and fieldwork remained integral parts of the curriculum (Feisel & Rosa, 2005, p. 122). Reform of the engineering programme will encourage gender parity as the findings of this study have shown that focus should not be only on the curriculum in classrooms but be extended to more worksites.

Some of the participants experienced positive learning experiences with their male peers. These were the female students who “presented themselves with stereotypically masculine characteristics” and assimilated to the masculine culture (Derks, Van Laar & Ellemers, 2016, p. 457) of engineering. These participants were those who mainly adopted the process of assimilation and they were also regarded by the male peers as “one of them”. In the process of assimilation, these female students felt privileged to be among the male group and to be performing “masculine acts” such as playing football, knowing mechanics, and adopting “masculine language”. Most importantly, the physical attire of such female students proved to enrich their learning experiences especially with the male group. The findings revealed that the process of assimilation made such female students compliant to the male students whereas those who were resistant had to “beat the boys”. By adopting the ways of the dominant group, some women practised assimilation as a strategy, another key aspect of the institutional gender regime of Fly University. In a male-dominated field, segregationism (women who do not conform to male established patterns of behaviour) keeps women in a corner, whereas assimilationism is about speaking on the same line as the majority group (Banchefsky & Park, 2018, p. 17). Therefore, instead of adding the feminine perspective to the engineering field, some women assimilated to the masculine culture by trying to fit into the male-dominated culture of engineering, where men are over-valued over women. Gender discrimination, which is a dominant feature of gender hierarchy, is maintained when women assimilate to the masculine culture of engineering.

Some resistant female students found it difficult to be in a man's world, especially during male dominance in class discussions and when sexist remarks were made.

The resistant female students were always in a situation where they had to prove that their knowledge and skills were not related to their femininity and that gender is not related to engineering. Harro (2000) argues that individuals are born into a social system wherein they take on a specific set of socially constructed identities. As the concept of socialisation relates to this study, male students often pictured a woman as being pretty, slim, and wearing dresses which is the reason why they thought that femininity did not go along with engineering.

The analysis undertaken thus served as a building block that enabled me to theorise my findings to answer the third research question.

### **7.3.3 Answering research question 3**

**Research question 3: Why do the gender regimes influence the learning experiences of female engineering students in the way they do?**

The gender regimes present in the engineering major of Fly University produce a range of socialisation patterns that have taught female students the ways in which they can ‘be an engineer’ in a male way. The learning influences focus on the following three aspects:

- (i) The construction of professional identity, shaping values, attitudes and relationship with knowledge;
- (ii) The knowledge that is regarded as being of greatest worth, through the curriculum; and
- (iii) The coherent and accepted practices, which remain, male dominated.

The female students must learn to make their place in the male-dominated world such as engineering. The participants are being socialised into a professional identity compatible to the engineering field. That professional identity includes strength, resilience, competition, and success, and all the experiences are geared towards that specific identity. Acquiring knowledge of the engineering major is of highest importance for the participants. By mastering the content of the curriculum, which results in achieving good grades, the participants extend their ability and skills and challenge the beliefs that engineering is not appropriate for them. The practices adopted towards female students in terms of special treatment and cultural

dominance are perceived as coherent and acceptable to academic teaching staff and students. The fact that engineering is a male-dominated field, these gendered practices reinforce the gender regimes. If values, knowledge, and practices are gendered, then the learning experiences will also be gendered.

The overall findings of the study show that the learning experiences of female engineering students, who enrolled on an engineering undergraduate programme, are influenced by a range of gender regimes present in this higher education institutional setting. Hence the peculiarities of the Mauritian context, complemented with the methodological innovative approach towards the phenomenon and the theoretical framing, have potentially uncovered and documented alternative conceptions of how gender regimes influence learning experiences of female engineering students.

## **7.4 Section 2: Contributions and implications of the study**

### **7.4.1 Contributions**

This study has contributed to the theoretical body of knowledge on gender regimes and learning experiences. Connell's theory of gender relations (2002), as described in chapter 2, was used with the purpose of exploring gender regimes and learning experiences. Connell's theory of gender relations focused on providing questions as guiding principles for the design of the data production methods. From the main method of data production (critical individual conversation), various categories of the gender regimes were identified, extracted, and developed by the researcher. The use of Connell's theoretical framework allowed me to explore in detail four dimensions of power that enable hegemonic masculinity and patriarchy, to show how they inform the gender regimes prevalent in this institutional setting.

In chapter 1, it was stated that the study provided insights for educators and policy makers to address the gender inequity and discrimination against women, to improve the prospects for future generations. My study has shown that many factors influence the learning experiences of female engineering students and the regimes present in Mauritian higher education institutions. The study could assist administrators of higher education institutions to redesign their engineering curriculum, including the review of teaching methods, the recruitment of more female students and that of academic teaching staff.

This section dwells upon the new understandings that my study has brought about. It discusses the emergent constructs that are of contextual and theoretical contributions.

#### **7.4.1.1 How the context shapes theoretical contributions**

The Mauritian context provides an interesting backdrop to study this specific phenomenon. First, it has met with a relative measure of success in reaching some gender equity in achievement in education where it is one of the few countries on the African continent where female students do better than their male counterparts. Second, despite its cultural diversity, the consensus of young women's education in middle and upper classes appears to be a won battle with women powerfully forging ahead in science and research with them winning hands down national scientific prizes. Third, its provisions for higher education have expanded drastically following its policy of turning Mauritius in a regional knowledge hub. It is one of the most forward-looking, well-governed states in the African continent and yet, these national achievements hide those deep fractures which exist at a micro level at one of its flagship universities. The Mauritian context, which is a multi-cultural one, is made up of the descendants of migrants from France, India, Africa, and China. Most of the participants in the study are of Asian origin; they are from liberal families who adopt a progressive discourse as evidenced by the fact that engineering is a legitimate career for women. Their male counterparts are not necessarily from similar class backgrounds and so, their discourse is heavily coloured by their social class. This is where the lens of intersectionality could become very useful in explaining the learning experiences of participants.

Although, as indicated before, I did not use intersectionality as the original lens for framing the research problem, the data is replete with references and insights related to concepts of power and dominance interspersed with culture and class as explanatory factors underpinning the differences in how the male-female learning relationships were negotiated. It does seem that culture, class, and gendered relations in the engineering classrooms are used to recode experiences. The participants are young Asian women who are mostly first-generation university students to take the risk of a professional scientific option. Because of their history, the participants are unlikely to take failure kindly. They have been educated in the most elite secondary

schools of the country and socialised into high expectations of themselves. Yet the systems (curriculum pedagogy and classroom experience) have reportedly broken a few. This is perhaps an indication of the differential speed of change in women's understanding of which they are as persons and soon to be professional engineers and how compatible the personal understandings are with the system and those who share the higher education space. If anything, this thesis throws open the question of how systems cohere with individuals' aspirations and perspectives and how both are heavily shaped by history and personal biographies as who they are as criss cross. For the Southern Asian women living in a small island developing state like Mauritius, if change is to come and if barriers are to be broken, they must do so on the concurrent efforts of the individual and existing institutions.

#### **7.4.2 Implications**

Hegemonic masculinity and patriarchal dividend, which are both established based on men's power (Connell, 2009), are embedded in educational institutions. However, they are not permanent, and they are subject to change. Moreover, often the enemies of feminism are the policies and decisions made by institutions instead of the lack of support for women by people (Pollack, 2015, p. 5). The findings of this study have implications on theory and on policy.

##### **7.4.2.1 Implications on theory**

The study reveals that engineering classes are gendered spaces constructed around gender relations, which influence the ways in which female students relate to their learning and their future professional careers. The constructs through which these are operationalised are multiple starting from how body image is attributed importance legitimising engineering as a male profession on account of the physical nature of work that is implied which disqualifies women. While there seems to be an acceptance of this "reality" for a few, it was found that women can reject this reductionist view of themselves by claiming competence and ability to trump the perceived weakness associated with their bodies. However, positive experience of the field serves to reaffirm female students' confidence as does the constant support of academic teaching staff who are generally keen to improve female students' confidence either out of conviction or even some subtle forms of patriarchy.

This study showed that some male students legitimised their power through an insidious process of anticipatory socialisation designed to signpost all the reasons why engineering is a male field. This included apart from foregrounding the physical inadequacy of their female classmate, the cultural barriers associated with the rough vocabulary of builders which are certain to cause discomfort to female engineers, the physically strenuous working environments, all of which are designed to assert a male reading of what engineering work is about.

What is however also evident is the acceptance of these views by some female participants who feel compelled to accept and conform to these views by accepting “male help” designed to enforce some form of control and superiority on the field. Showing compliance is a way of getting access and acceptance.

Resistance by female students is expressed not so much in fieldwork as it is in the classroom. “Beating the boys” on their own preferred terrain of abstract thinking appears to be a way for some participants to level the field despite again attempts to represent engineering knowledge as “male”. The findings reveal that keeping this knowledge within male circles or only allowing privileged female students to access such understandings is a common gatekeeping exercise endorsed by male classmates.

The role of academic teaching staff is also surfaced in the thesis namely how female academic teaching staff act as a prime mover facilitating epistemic access through relevant pedagogical methods and some form of positive discrimination. Though, from a liberal feminist perspective, this practice is less well regarded and it does point to the fact that in higher education, recognition of the position of female students in engineering courses is contested from within (male peers) and needs to be consolidated.

However, the study also foregrounds nuanced experience on account of the various enactment of masculinities by male peers. As university years are formative in terms of male identity, it means that such enactments are carried over from previous experiences in the family in schools and with the media. The present study thus shows how cultural conceptions of women’s place in engineering originating from

families and schooling experiences continue to endure with both male and female engineering students. More importantly how these may work against structures designed to remove those barriers to equal opportunities. However, hope comes in the form of female resistance exercised silently by rejecting stereotyping and performing to a level which forces recognition of competence. Women in engineering, as women in other competitive fields, need to work harder than their male counterparts sometimes for less reward.

#### **7.4.2.2 Implications on policy**

Academic teaching staff are the ones who have to reunite policy and practice and yet, ironically, are more often left out of all policy initiatives. The fact that academic teaching staff spend considerable time in the teaching context makes them more sensitive to the dynamics in the operation and the implications of implementing policy decisions through the curriculum. Additionally, since they mediate the curriculum and the students, they can measure its relevance.

Academic teaching staff are thus vital to the process of policy development. In order to achieve desirable outcomes, policy makers must not lose track of feasible outcomes and should therefore work in partnership with academic teaching staff, giving them the space to adjust the curriculum in line with their students' varying profile. The curriculum should take into consideration the local context.

The findings of the study would certainly make for more coherence while translating policy into practice. The study has clearly established the need for administrators of higher education institutions and academic teaching staff to rethink the delivery of engineering programmes at university. However, policy makers can advise public higher education institutions to review their recruitment policy to increase the recruitment of more female academic teaching staff on engineering programmes. To make Mauritius competent and internationally competitive in STEM, policy makers and educators will have to reduce gender inequity in STEM as part of the Sustainable Development Goals with Gender Equality being central to the achievement of all goals. In line with Goal 5 of the Sustainable Development Goals, achieving gender equality and empowering all women and girls in STEM should be a priority for the state because gender equality includes the wellbeing and

capabilities of all the citizens, enabling all citizens to reach their potential, irrespective of gender.

#### **7.4.2.2.1 Female students**

This research has revealed that Mauritius will be able to meet its future challenges better by addressing the challenges faced by women in higher education institutions, thus encouraging more female students to study engineering, which will reduce the gender gap in the engineering field. The education sector is to ensure that more women are enrolled on STEM programmes in higher education and more women are recruited in STEM careers.

The Education and Human Resources Strategy Plan 2008-2020 of the then Ministry of Education, Culture and Human Resources (2009, p. 9) puts emphasis on the necessity for main reforms in the existing education sector. One of the major objectives of the Ministry of Education, Tertiary Education, Science and Technology is to enable all students to complete higher education to ensure employability. Since the 2019 General Elections, the Government of Mauritius has renamed the Ministry responsible for the education sector to include science and technology, to show the importance that science and technology have in the Mauritian society. This study would assist in attaining this objective of the Ministry by developing knowledge about what helps women to join and be successful in STEM in higher education. Addressing gender regimes has implications for breaking away with patriarchy and ensuring sustainability in Mauritius. Being a small island state, Mauritius is struggling to ensure a more effective utilisation of its human capital and to render its human resources more responsive to the merging needs of the economy. This study could assist in the integration of more women in the engineering sector.

Although all students, irrespective of their gender, are given the opportunity to enrol on any programme based on merit in the higher education institutions in Mauritius, many of them complete higher education with less confidence particularly in the engineering field. This is reflected in the world of engineering where many female professional engineers are not confident. According to Watt (2016), the challenge of increasing more women in engineering particularly through an economic lens, involves a STEM pipeline. This pipeline defines “a flow of engaged students in

primary school leading to recruitment of students to secondary and senior secondary STEM subjects” (Timms, Moyle, Weldon & Mitchell, 2018, p. 4). Thus, the number of female students in engineering demands a multipronged strategy incorporating policy makers, administrators and teaching staff right from the very early years of schooling so that all obstacles to reproduction of gender regimes tending to perpetuate gender inequity be removed.

As shown in chapter 1, the statistics regarding the enrolment of female students in engineering is not encouraging. There is a crucial demand to make use of the potential of female students and women in the national population. As indicated in chapter 1, though gender gaps in engineering are narrowing in some areas, the need to increase the number of female students who enrol for engineering is pressing. There is a need for a workforce with STEM skills to drive the economic prosperity of a country (Timms, Moyle, Weldon & Mitchell, 2018, p. 1). Mauritius should make use of its human resources both from the angle of assets as well as the liabilities connected with the attainment of economic development. Currently under-represented groups such as women would be a possible solution to contribute to the development of the country.

This study has shown that Mauritius will be better able to meet future challenges by encouraging more female students to study male-dominated fields such as the engineering field which would allow more women to engage in an engineering career. The Ministry of Gender Equality, Child Development and Family Welfare and the Ministry of Education, Tertiary Education, Science and Technology should ensure that more efforts are made at the higher education to recruit female students into engineering and encourage gender mainstreaming so that more women are employed in the engineering field and can thus meet national needs, enabling the country to progress. So long as the curriculum and teaching methods adopted by academic teaching staff and the quota of female academic teaching staff do not change, the learning experiences of female students will not improve greatly. Their lack of positive learning experience, which results in a lack of self-confidence and a perception of engineering as a male domain, will remain unchanged.

#### **7.4.2.2.2 Academic teaching staff**

Gender issues need to be acknowledged by academic teaching staff and their commitment to create a teaching and learning environment, which is welcoming to female students in engineering in higher education. The findings of this study showed that the female students specified their preference for being taught engineering by a female academic teaching staff. To create an environment that is free of gender regimes, higher education institutions, including academic teaching staff and students, should consider having incentives to encourage female students to join male-dominated fields in higher education. According to Ingvarson, Reid, Buckley, Kleinhenz, Masters and Rowley (2014), teacher quality has an impact on student learning and thus, it is important to recruit, develop and retain high quality academic teaching staff in engineering. Professional development enables teaching staff to “build skills and confidence in STEM teaching” (Timms, Moyle, Weldon & Mitchell, 2018, p. 4). Appropriate training should be given to academic teaching staff (both male and female) to deal with minority students (both male and female) on a specific programme. The gender composition of faculty was found to be an important factor that influenced the learning experiences of the female engineering students. “Female role models in STEM are one enabler, through school visits by women working in STEM, female STEM teachers and researchers” (Timms, Moyle, Weldon & Mitchell, 2018, p. 14). Higher education institutions must make significant effort to appoint a diverse faculty in the engineering field where women are fairly represented. The findings suggest that female academic teaching staff act as role models to female students. A positive relationship between female engineering students and female academic teaching was established. Recruiting more female academic teaching staff would be to make female students have more role models.

#### **7.4.2.2.3 Curriculum**

It was found that the engineering curriculum is not based on a modern conceptualisation. An integrated engineering curriculum has been defined by Moore and Smith (2014) as “an effort to combine some or all of the four disciplines of science, technology, engineering, and mathematics into one class, unit, or lesson that is based on connections between the subjects and real-world problems”. Thus, an integrated engineering curriculum needs to be carefully designed to enable the

students to see and understand the connection between the theory being taught and real-life applications. A more gender-friendly engineering curriculum mirroring real world arguments and applicable to everyday life could help support an increased interest in engineering from female students. In this study, it became obvious that the academic teaching staff were not aware of gender-friendly approaches to make engineering more interesting to female students in higher education. Initiatives could be taken to include a module on gender issues in every programme offered in higher education institutions, to enable all students to understand the other gender and to reduce stereotyped beliefs that are held by some students. Such a module could be seen in the different roles that men and women tend to play in family and workplace settings, thus ensuring that both men and women are supporting gender equality and discouraging the practice of gender regimes in any context (home, educational institutions or workplace).

The curriculum materials within what are currently male-dominated programmes may include images of women in the field of engineering. They are to be developed to inform academic teaching staff on gender issues in engineering education and have examples of women acting as role models in the engineering fields. By organising workshops involving deans of faculties, academic teaching staff, relevant ministries and non-governmental organisations, the topic of gender and engineering could be examined, and appropriate programmes and projects could be introduced and executed in higher education institutions.

The engineering curriculum should be reviewed to encompass adequate fieldwork, practicals and theory. A more gender-friendly engineering curriculum mirroring real world themes related to everyday life could enhance female students' interests in engineering. Policy makers must also identify suitable pedagogy in science education in the early years in primary education that would assist children to unpack ideas and progressively support knowledge and understanding of engineering concepts in higher education. The structure of the programme could be reviewed to cater for more practicals and industrial training, which would improve the learning experience of students in the real world.

Higher education institutions could have collaborative provisions with industries to enable students to have the opportunity for more industrial training, which links the theory learnt in class and the real world of work. Improved teaching methods and curricular resources would on their own assist in increasing the enrolment of female students in the engineering field, enable them to have a pleasant learning experience, enable them to follow career paths in the engineering fields and eventually to participate equally as men in national development.

From my findings, it appears that teaching methods have not changed, and most academic teaching staff adopt the traditional chalk-and-talk methods that dominate the teaching and learning of engineering. New teaching strategies could be used to encourage active learning. Using an active learning environment could improve the integration of practicals and theory within the classroom, which would help students to be involved in higher order thinking (analysis, synthesis, evaluation). Higher education institutions should encourage student-centred teaching strategies where class discussions and the voice of students are fully acknowledged. It will be the responsibility of each higher education institution to ensure that their academic teaching staff are using student centred teaching methods.

### **7.5 Section 3: Limitations of the study**

A limitation is a shortcoming of the study that cannot be coordinated by the researcher (Cohen, Manion & Morrison, 2007). The unwillingness of some female students to participate in the research and their declining participation in my study led to a small sample of participants. An explanation for their refusal was that they were not interested in my study and they thought that this would disrupt their learning routine and eventually their studies. Through their body language, some of the female students were even making fun of the female students who agreed to participate in the study. A limitation of the study was, therefore, the small sample of participants.

Given that the research culture at the Faculty of Engineering at Fly University is mainly quantitative, focus group discussions and interviews are uncommon. Moreover, the study was conducted only for one of the majors offered at the Faculty of Engineering.

A further limitation of the study was that I could not get Year 4 participants from the first stage of critical individual conversations to enter the second stage of critical individual conversations. During the second stage, Year 4 participants had already graduated.

Another limitation of the study was that the participants were only female students. Had there been male students as participants, there is a possibility that the findings would have been different.

## **7.6 Section 4: Future directions for research**

This study has used a research approach that has illuminated the reality of how gender regimes influence the learning experiences of female engineering students in a higher education institution in Mauritius. In this chapter, the ‘operations of gender regimes in higher education institution’ were presented. The answers to the three research questions show that it is challenging to untangle which factors are more significant than the others. By objectively undertaking the research methods (qualitative questionnaire, focus group discussion and critical individual conversation) and transcribing the qualitative questionnaires, focus group discussions and critical individual conversations, and outlining all the stages of data analysis and interpretation with my supervisors, I made every effort to guarantee that the findings are unbiased and will gain critical analysis by others.

Despite the limitations of the study, according to me, the study has prepared the way for further research in the field of STEM and STEM students. I will conclude by suggesting several supplementary possibilities that could be explored, all of which would highlight the issue of gender and STEM, especially in higher education institutions in Mauritius. Future areas of research to be considered are suggested below:

- Further research could be carried out with students enrolled on other STEM programmes to explore their learning experiences. This could shed more light on how other programmes are delivered, including how students of higher education institutions experience STEM programmes.

- Gender regimes could be further explored, with female academic teaching staff as participants. Such a study would shed light on the gender regimes that exist at the level of academic teaching staff.
- Analysis of textbooks could be done to explore gender construction in the engineering texts and how this influences the study of engineering of female students. This exercise could be supplemented by interviews with textbook authors.
- The influence of role models in engineering is a space that could be investigated further. Inviting professional women engineers to organise seminars and workshops on their work and emphasising how the practice of engineering is imperative in this fast-developing world, would be one approach to this. A consequent survey by researchers would help to indicate to what extent this involvement has been fruitful in attracting female students to engineering.

## 7.7 Chapter summary

Research questions 1, 2 and 3 were answered in line with the theoretical framework used in this study. This chapter represents the end point of the study that was undertaken. It highlighted the implications of the study with respect to gender regimes and female engineering students. It was deemed that the study had provided further insight into the area researched. The chapter concluded by proposing future possibilities for research.

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# Appendices

## Appendix 1: Ethical Clearance Document (14 October 2015)



14 October 2015

Mrs Noshmee Devi Baguant 213573142  
School of Education  
Edgewood Campus

Dear Mrs Baguant

Protocol reference number: HSS/1175/015D

Project title: Gender regimes and learning experiences of female engineering students at a higher education institution in Mauritius

### Full Approval – Expedited Application

In response to your application received on 18 August 2015, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have been granted FULL APPROVAL.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully,

Dr Shenuka Singh (Chair)  
Humanities & Social Sciences Research Ethics Committee

/pm

cc Supervisor: Dr Thabo Mslbi & Dr Hyleen Mariaya  
cc. Academic Leader: Professor P Morojele  
cc. School Administrator: Ms T Khumalo

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Humanities & Social Sciences Research Ethics Committee

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Website: [www.ukzn.ac.za](http://www.ukzn.ac.za)

## **Appendix 2: Informed Consent Form**

Gender regimes and learning experiences of female engineering students at a higher education institution in Mauritius

### **Declaration**

I \_\_\_\_\_ (full names of participant) hereby confirm that I understand the contents of this document and the nature of this research project and I consent to participating in the qualitative questionnaires, critical individual conversations and group discussions.

I understand that I am at liberty to withdraw from the project at any time, should I so desire.

\_\_\_\_\_  
SIGNATURE OF PARTICIPANT

\_\_\_\_\_  
DATE

### **Appendix 3: Participant Information Sheet**

Gender regimes and learning experiences of female engineering students at a higher education institution in Mauritius

Dear Participant,

I invite you to take part in a research study which will offer the possibility to examine the student-self (including the curriculum), student-student and student-faculty dimensions of female students' learning experiences doing engineering and understand as to how and why gender regimes influence the learning experiences of female engineering students at a higher education institution in Mauritius in the way they do.

I will conduct three critical individual conversations with you at your place of convenience. The duration of each of these critical individual conversations will be approximate one hour. The critical individual conversation will be audio recorded. Every effort will be made to ensure that no one will know that you took part in this study. If I use any information that you share with me, I will be careful to use it in a way that will prevent people from being able to identify you. To protect your identity, I will ask you to provide a different name during the critical individual conversation. You are free to withdraw from the research at any stage without negative or undesirable consequences. All information is only intended for the research purposes. All data recordings and transcripts will be stored in a locked cabinet.

Permission to conduct this research study has been obtained from the University of Mauritius. Should you require any clarification regarding the study, you may contact me on noshmee@gmail.com or on 5784-3033.

Thank you for your co-operation.

---

Noshmee Devi Baguant (Mrs)

## Appendix 4: Recertification Approval of Ethical Clearance (15 January 2019)



15 January 2019

Mrs Noshmee Devi Baguant 213573142  
School of Education  
Edgewood Campus

Dear Mrs Baguant

Protocol reference number: HSS/1175/015D

Project title: Gender regimes and learning experiences of female engineering students at a higher education institution in Mauritius

### Recertification Approval

This letter confirms that you have been granted Recertification Approval for a period of one year from the date of this letter. This approval is based strictly on the research protocol submitted in 2015

Any alterations to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study must be reviewed and approved through the amendment /modification prior to its implementation. Please quote the above reference number for all queries relating to this study. PLEASE NOTE: Research data should be securely stored in the school/department for a period of 5 years

Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

\*\*\*\*\*  
Dr Rosemary Sibanda (Chair)  
Humanities & Social Sciences Research Ethics Committee

cc Supervisor: Dr Thabo Msibi & Dr Hyleen Mariaya  
cc. Academic Leader: Dr SB Khoza  
cc. School Administrator: Ms Sheryl Jeenaarain



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Humanities & Social Sciences Research Ethics Committee

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Website: [www.ukzn.ac.za](http://www.ukzn.ac.za)



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## Appendix 5: Participant's Qualitative Questionnaire

Dear Participant

I am carrying out a survey on gender and the engineering field in higher education level. I would be very grateful if you could fill in the qualitative questionnaire. Feel free to answer the questions in either English, French, or Creole. Please rest assured that all information will be kept confidential and in strict anonymity.

Thanking you,  
Noshmee Devi Baguant

### Part 1-Information

Name of the participant (Optional): \_\_\_\_\_

Mob. No. (Optional): \_\_\_\_\_

Email Address: \_\_\_\_\_

Time: \_\_\_\_\_

Date of Qualitative Questionnaire: \_\_\_\_/\_\_\_\_/\_\_\_\_ Place: \_\_\_\_\_

### Part 2- Qualitative Questionnaire

1. Your current Year of Study in the course BEng (Hons) Civil Engineering?

Year 1 ☐ Year 2 ☐ Year 3 ☐ Year 4 ☐

2. What do you enjoy the most in doing in the course BEng (Hons) Civil Engineering?

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3. How would you qualify the relationship among students of your class?

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4. What kind of relationship do you share with boys in your classroom?

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5. What are your views on the curriculum?

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6. What would you tell other girls to encourage them to enrol on the course BEng (Hons) Civil Engineering?

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## **Appendix 6: Focus Group Discussion Questions**

1. What are your views on the course with regard to its curriculum?
2. What are your views on the resources provided at the university for the course?
3. In what ways do you think the curriculum can be different?
4. Tell me something about your classmates? Can you say more?
5. Are they helpful you have a problem in a module? Can you give an example?
6. How do the boys in your class behave with you?
7. Who was the best lecturer you had? Why?
8. Who was the most supportive lecturer? Why?
9. Which modules did you enjoy? Can you explain further?
10. Which modules did you struggle with? Why?

## **Appendix 7: Critical Individual Conversation Questions**

6 female engineering students from Year 1, Year 2 and Year 4 from the BEng (Hons) Civil Engineering at a higher education institution were purposively chosen from the qualitative questionnaire and interviewed individually. The critical individual conversation was conducted at the place of convenience of the participants. I used the following questions to guide me on the critical individual conversation.

1. What type of secondary school did you attend?
2. How did you come to choose civil engineering?
3. Why do you think it is important for girls to study civil engineering?
4. What are some of the memorable experiences of studying civil engineering you have had as a student at this institution?
5. If you were teaching civil engineering, which module(s) would you teach? Why? How?
6. Which topics/modules, you struggled? Why? Who supported you?
7. How do you cope when you have a problem in civil engineering? Who helps you?
8. Are the boys and girls in your classroom given the same attention by the academic faculty?
9. Do the boys of your class interact with other girls enrolled on other programmes, at the university?
10. What are your views on the resources used in the course?
11. Can you suggest how they should be in your opinion?
12. Who was the best lecturer you had? Why?
13. Would you prefer a male or a female academic faculty to teach you civil engineering? Why?
14. Any other comments.

## **Appendix 8: Findings from the pilot study**

### **Findings from the qualitative questionnaires in the pilot study**

#### ***Most enjoyable in the programme***

- Civil engineering comprises water and wastewater engineering which is interesting
- Onsite investigations, laboratory studies, inspections and finding solutions to problem
- Civil engineering englobes creativity and I would enjoy to be involved in the construction of man-made structures
- It consists of both theory and practical

#### ***Relationship among student of your class***

- Friendly relationship in doing homework and assignment.
- Some students are selfish and don't share their knowledge
- The factor of being a girl is often highlighted

#### ***Relationship with boys in your class***

- Friendly
- 'there are times when we would disagree and fight with each other'
- The boys think differently and this helps us to build our character and personality to enable us to cope with our future professional career
- More helpful than girls
- Some prefer to be only in the boys' group rather than integrating with the girls
- Some are arrogant

#### ***View on curriculum***

- Too little onsite training
- For a girl, 6 months onsite training would have given us a glimpse of the world of work
- New modules learnt like statistics

#### ***Encourage other girls to enroll on the programme***

- People may discourage girls to enter this field, but girls should do it
- Girls should enter this male-dominated field and unleash their potential and they will succeed
- Girls to stand on their feet and not to be afraid of any obstacles
- Civil engineering not about boys and it is a pride for a girl to be in this field
- Interesting course but tough

## **Findings from the focus group discussion in the pilot study**

### ***Curriculum***

- Includes modules like statistics, economics
- Lab work done in first and second year, in year 3 only theory
- Too much theory in year 3

### ***Resources provided***

- Easy access to resources in the library

### ***Ways in which the curriculum can be different***

- To increase the training. Only two months of training in the fourth year is not sufficient
- It is on the onus of the students to choose the place for internship
- 

### ***Who helps you when you have a problem in a module***

- The lecturer or friend in our group (girls and boys)
- Only the boys in our respective group
- We hesitate to ask other boys, we don't know how they will react

### ***Behaviour of the boys***

- Friendly, helpful and supportive
- Some don't like to interact with boys because these boys were already friends in secondary school
- There are not many girls in the class, the boys do not find it important to mingle with the girls
- They make moquerie when girls answer questions asked by lecturers

### ***Male lecturers***

- Nicer to girls than to boys
- Majority of lecturers are male, there are only 2 female lecturers
- We prefer male lecturers to female lecturers
- Male lecturers severe with boys
- Male lecturers verify homework of boys but not for girls
- We are less in number so we have special treatment

### ***Fieldwork***

- Looks so exciting to wear caps, boots
- Once I had an argument with one of the boys who was not respectful with the masons
- Girls treat the masons with lots of respect
- Boys underestimate girls

- Women engineer on the field did not like the girl

### **Findings from critical individual conversation in the pilot study**

#### ***Choice of civil engineering***

- By elimination
- More job prospects for civil engineering
- Good results at HSC
- Covers wastewater management
- From good feedback from others on the programme
- Aware of what will be covered during the course

#### ***Importance of engineering for girls***

- More girls should do civil engineering
- Girls can do any field

#### ***Any memorable experiences during your studies***

- Good memories, we enjoy a lot
- Boys immature
- Play jokes
- Bad memory: Once the boys hid my shoes and I was angry. Boys like playing jokes with me may be because physically I am small. During practical, one boy commented that I was not doing anything. I did not like that, now he gives me light work
- During internship, I was supposed to lift macadams, and was unable to do it.

#### ***Which module you would teach as a lecturer***

- I would not like to teach Analysis and Design because he is too good and I would not be able to teach the module the way he does

#### ***Which topics you struggled? Why? Who supported you?***

- I enjoy the modules

#### ***Who helps you when you have a problem***

- Friends (boys and girls) in the group
- The lecturer in class

#### ***Are all students given same attention by academic faculty***

- Male lecturers are severe with the boys
- Male lecturers verify boys homework and do not verify for girls
- Male lecturers nicer to girls
- Some boys meet the lecturers quite often after lectures and they are give more attention

### ***Resources***

- Recommended books are not easily available

### ***Would you prefer male or female teaching staff***

- Male lecturers are nicer
- Only 2 female lecturers
- Majority of lecturers are male
- My favourite lecturer is a male

### Appendix 9: An example of an expression in ‘Kreol Morisien’

Mia: [original utterance in ‘Kreol Morisien’] “*Banela ti pe pren **nisa** ar nou kan nou ti p reponn questions dan classe*”

[English version: “They were **making fun of** us when we answered questions in class.”]

In the *Diksioner Morisien* (Mauritian Dictionary) (2011), the word *nisa* means intoxication. ‘Intoxication’ would be a literal translation of the term *nisa* but inadequate in terms of the message it wants to give. *Intoxication* would be inappropriate it would imply that the participant was intoxicated when she was answering questions in class. The term *making fun of* deemed more appropriate.

**Appendix 10: An extract from focus group discussion 3 and an extract from Salima's critical individual conversation**

Extract from focus group discussion 3:

*"Friendly, all students work together and willing to help each other when someone has difficulty to understand a particular chapter or problem."*

Extract from Salima's critical individual conversation:

*"The boys of my class are quite friendly with me compared with other girls of my class. I feel as comfortable with them as I feel with the girls."*

## Appendix 11: Certificate from Language Editor

Crispin Hemson  
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Glenwood  
Durban  
South Africa 4001

[hemsonc@gmail.com](mailto:hemsonc@gmail.com)  
0829265333

---

This is to confirm that I have undertaken language editing of a doctoral thesis by Noshmee Devi Baguant entitled **Exploring the influences of gender regimes in the learning experiences of female engineering students at a higher educational institution.**



4<sup>th</sup> August 2020

## Appendix 12: Turnitin Report

### Turnitin Originality Report

Processed on: 12-Aug-2020 01:26 +04  
ID: 1352551284  
Word Count: 77681  
Submitted: 3

EXPLORING THE INFLUENCES OF GENDER REGIMES IN... By  
Noshmee Baguant

Similarity Index  
**10%**

The screenshot displays the Turnitin feedback studio interface. The top header shows the document title "EXPLORING THE INFLUENCES OF GENDER REGIMES IN THE LEARNING EXPERIENCES OF FEMALE ENGINEERING STUDENTS AT A HIGHER EDUCATION." and the author "Noshmee Baguant". The main document preview area shows the beginning of "CHAPTER 1: CONTEXTUAL AND GENDER IN MAURITIUS", with a highlighted section "1.1 Introduction" discussing the field of Science, Technology, and the participation of women in STEM. A pop-up window titled "Info" provides submission details: Submission ID 1352551284, Submission Date 11-Aug-2020 10:48PM (UTC+0200), Submission Count 3, File Name TURNITIN\_Thesis\_Final1\_12.08.2..., File Extension doc, File Size 1.17M, Character Count 439657, Word Count 77681, and Page Count 230. On the right, a "Match Overview" panel shows a total similarity index of 10% and a list of nine matches, including internet sources and student papers, each with a similarity percentage.

Match Number	Source	Similarity Index
1	bura.brunel.ac.uk Internet Source	1%
2	Submitted to University... Student Paper	1%
3	Submitted to University... Student Paper	<1%
4	hdl.handle.net Internet Source	<1%
5	repository.up.ac.za Internet Source	<1%
6	Submitted to Open Uni... Student Paper	<1%
7	uir.unisa.ac.za Internet Source	<1%
8	Submitted to Laureate ... Student Paper	<1%
9	journals.ufs.ac.za Internet Source	<1%

## Appendix 13: Proof of submission of a paper to a journal

From: **Susan Sun** [ijhe@sciedupress.com](mailto:ijhe@sciedupress.com)  
Subject: [IJHE] Submission Acknowledgement  
Date: August 11, 2020 at 8:19 PM  
To: Mrs Noshmee Devi Baguant [noshmee@gmail.com](mailto:noshmee@gmail.com)

SS

Mrs Noshmee Devi Baguant:

Thank you for submitting the manuscript, "Gender and engineering in higher education: the case of Mauritius" to International Journal of Higher Education. With the online journal management system that we are using, you will be able to track its progress through the editorial process by logging in to the journal web site:

Manuscript URL:  
<http://www.sciedupress.com/journal/index.php/ijhe/author/submission/18635>  
Username: nbaguant

If you have any questions, please contact me. Thank you for considering this journal as a venue for your work.  
Best Regards,

Susan Sun  
Editorial Assistant, International Journal of Higher Education

-----  
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