The Experiences of Male and Female Students of BET - Mechanical Engineering Technology, MSU-IIT, Iligan City: A Longitudinal Study

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ABSTRACT

This longitudinal research project investigates the academic performance and gendered experiences of the pioneering cohort of the Bachelor of Engineering Technology major in Mechanical Engineering Technology (BET-MET) under the revised curriculum at MSU-IIT, Iligan City, Northern Mindanao, Philippines. It specifically analyzes the academic progression of male and female students from first year to fourth year, using their official grades recorded in the MSU-IIT computer system. The study combines both quantitative and qualitative approaches to provide a comprehensive understanding of students' academic outcomes and their gendered experiences within the program. A survey questionnaire was used to gather quantitative data from students, while individual interviews and Focus Group Discussions (FGDs) with faculty members captured qualitative insights. Wilcoxon's rank-sum test, also known as the Mann-Whitney U test, as adapted from Felder et al. (1998), was applied to determine significant differences in academic performance between male and female students. Additionally, qualitative content analysis was employed to interpret the narratives gathered from interviews and focus group discussions (FGDs). Findings reveal that students, regardless of gender, placed significant value on their coursework and demonstrated a strong sense of academic autonomy. However, female students reported instances of gender discrimination, particularly during their On-the-Job Training (OJT), pointing to persistent gender inequality in workplace environments. Furthermore, gender biases were identified in the curriculum and instructional practices of the BET-MET program. In light of these findings, the study recommends the implementation of a Phase 2 Gender Sensitivity Training Program targeting stakeholders of the BET-MET program under the College of Engineering and Technology (COET) as part of its Gender and Development (GAD) Extension initiative. This initiative aims to foster a more inclusive, equitable, and gender-responsive academic environment.

Keywords: Gender and Engineering Education, Longitudinal Study, Mechanical Engineering Technology

INTRODUCTION

The implementation of the K-12 basic education reform in the Philippines has brought significant changes to the country's higher education curriculum, particularly in technical and engineering programs. The Bachelor of Engineering Technology major in Mechanical Engineering Technology (BET-MET) at Mindanao State University – Iligan Institute of Technology (MSU-IIT) has adopted a revised curriculum to align with the outcomes-based education (OBE) framework and the K-12 transition. The first cohort of students under this new curriculum has now graduated, providing a unique opportunity to assess both academic performance and gendered experiences within the program.

This research investigates the academic performance of male and female students in the BET-MET program from the first year to the fourth year, as reflected in the institutional academic records. It also explores how gender, community background (rural, urban, or suburban), and socio-emotional factors such as anxiety, confidence, and perceived fairness contribute to students' academic outcomes. The study places special emphasis on the experiences of students from small towns and marginalized groups who may face systemic disadvantages and internalize poor performance due to structural and cultural barriers.

Beyond academic metrics, this study analyzes the lived experiences of students through gender-disaggregated

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data, aiming to uncover inequalities in curriculum design, instruction, and training experiences such as On-the-Job Training (OJT). These findings will serve as a basis for revisiting the syllabi, teaching strategies, and student support mechanisms within the program.

Anchored on CHED Memorandum Order (CMO) No. 1, Series of 2015, which mandates the mainstreaming of gender in all areas of higher education—including curriculum, research, extension, and administration—this study contributes to the broader goal of developing a gender-responsive and inclusive engineering education. The results are expected to inform policy and curricular reforms that promote equity and empower both male and female students in technical fields.

This study seeks to explore the lived academic and social experiences of male and female students enrolled in the Bachelor of Engineering Technology (BET) - Mechanical Engineering Technology program at MSU-IIT, Iligan City. To enhance its relevance and generalizability, the research scope has been broadened to include multiple higher education institutions offering similar programs in the Philippines. This comparative approach enables a more holistic examination of gendered experiences in engineering education across diverse institutional settings. The study is guided by a commitment to gender inclusivity, equity, and the recognition of diverse student identities and challenges in STEM fields.

Objectives

This research project aims to analyze the academic performance and gendered experiences of male and female students enrolled in the new curriculum of the Bachelor of Engineering Technology major in Mechanical Engineering Technology (BET-MET) at MSU-IIT. The study seeks to determine whether the curriculum is gender-responsive and aligned with the goals of CHED Memorandum Order No. 1, Series of 2015.

Specifically, this study seeks to:

1. **Describe the profile of the respondents** in terms of:
    a. Sex
    b. Section
    c. Age
    d. Marital status
    e. Community type (urban, suburban, rural)
    f. Living arrangement (e.g., with parents)
2. **Determine if there is a significant difference** in the academic performance of male and female students from first year to fourth year in the BET-MET program.
3. **Examine gender-based perceptions and experiences** of students about:

    Reasons why women in engineering technology may leave the course Gendered experiences in subject-specific competence Attitudinal beliefs of engineering technology students by gender Obstacles faced by female students in engineering technology Gender-related experiences of female engineering technology students
4. **Identify significant differences** between the experiences of male and female students in the BET-MET program, particularly during key academic and training phases such as On-the-Job Training (OJT).
5. **Draw implications from the findings** to recommend improvements toward a more gender-responsive curriculum and institutional practices within the College of Engineering and Technology at MSU-IIT.

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LITERATURE REVIEW

The implementation of the K-12 reform in the Philippines has led to significant restructuring in higher education curricula, particularly in engineering and technology programs. According to Malipot (2017), the K-12 program was designed to enhance the quality of graduates and equip them with skills necessary for both local and international employment. However, the transition has also posed challenges in curriculum development and assessment of student performance in technical fields.

Gender disparities in engineering education have been widely documented. Balgos (2018) argues that while there has been increased participation of women in engineering and technology fields in the Philippines, gendered expectations, stereotypes, and lack of institutional support continue to affect their retention and performance. Research by Felder et al. (1998) also indicates that male and female engineering students experience courses differently, with women often reporting less confidence in their abilities despite comparable academic outcomes.

In the Philippine context, the Commission on Higher Education (CHED) has responded to gender inequality in education through Memorandum Order No. 01, Series of 2015. This policy mandates all higher education institutions (HEIs) to integrate gender mainstreaming across core functions: instruction, research, extension, and institutional operations. According to Angeles (2019), the CMO promotes not just equal access but also the transformation of gender norms and roles within the academic environment.

Moreover, the experience of students from rural or small-town backgrounds is a critical factor influencing academic performance. Research by Manalang and Sinco (2020) found that students from less privileged areas often face cultural and institutional barriers, including lower confidence levels, which can impact their academic engagement and achievement.

These studies underscore the need for longitudinal and gender-disaggregated analyses to ensure that new curricula are inclusive and equitable, particularly in male-dominated fields like mechanical engineering technology.

This research addresses a critical gap in engineering education literature in the Philippine context by providing longitudinal, gender-disaggregated data on students' experiences. By incorporating multiple institutions and stakeholder voices, the study is positioned to inform gender-responsive policy and curricular reforms. Furthermore, acknowledging external socio-cultural influences, such as gender norms and family expectations, enhances the cultural relevance of the findings.

The study contributes to the ongoing discourse on gender equity in STEM, with potential implications for improving educational practices, mentorship models, and support services for underrepresented groups in engineering. Ultimately, this research aims to influence both academic and industry strategies to foster inclusive, diverse, and equitable environments in the field of mechanical engineering technology.

METHODS

Research Design

This study adopted a **longitudinal mixed-methods design**. Quantitative data were used to track academic performance over four years, while qualitative methods provided depth and context to gender-based perceptions and experiences. The longitudinal approach enabled the tracking of academic progress and patterns across time.

Participants and Sampling

The respondents consisted of **120 students** from the first batch under the new BET-MET curriculum at MSU-IIT. A combination of **purposive** and **total population sampling** was used:

- All 120 students were surveyed for academic performance and perception data.
- A subset of 20 students (10 males, 10 females) and 5 faculty members were selected for in-depth interviews and Focus Group Discussions (FGDs).

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Data Collection Methods

1. Quantitative Data Collection:

- **Student Grades**: Academic performance data (GWA) from 1st to 4th year were obtained from the MSU-IIT student information system.
- **Survey Questionnaire**: A structured survey using a 5-point Likert scale was used to capture student perceptions on gender-related issues such as confidence, discrimination, and barriers in engineering education.

2. Qualitative Data Collection:

- **Focus Group Discussions (FGDs)** and **Key Informant Interviews (KIIs)** were conducted with selected students and faculty to provide context and personal narratives related to gendered experiences and curriculum implementation.

Data Analysis

Quantitative Analysis:

- Descriptive statistics (mean, frequency, percentage) were used to summarize respondent profiles and performance data.
- **Mann-Whitney U Test** (Wilcoxon rank-sum test) was employed to compare academic performance and perception data between male and female students. This non-parametric test was chosen because of the small sample size and non-normal distribution of grades, aligning with the statistical method used by Felder et al. (1998).

Qualitative Analysis:

- **Content analysis** was used to examine transcripts from FGDs and interviews. Thematic coding was employed to identify recurring themes such as discrimination, curriculum responsiveness, and gendered experiences in OJT and classroom settings.

To provide a comprehensive understanding of the experiences of engineering students, this research employs a **mixed-methods longitudinal design**, combining both quantitative and qualitative data collection and analysis. Surveys, interviews, and focus group discussions will be conducted at regular intervals over the course of the students' academic journey to capture evolving experiences.

Key enhancements in the methodology include:

- **Broader Sampling**: Participants will be selected from MSU-IIT and at least two other state or private universities with comparable BET - Mechanical Engineering Technology programs.
- **Participant Engagement**: Mechanisms for **regular follow-up**, such as scheduled updates and feedback sessions, will be implemented to ensure data consistency and participant retention throughout the study period.
- **Stakeholder Perspectives**: In addition to student voices, data will be gathered from **faculty members and industry partners**, enriching the analysis with insights into curriculum relevance, work-readiness, and gender-related challenges from an institutional and professional standpoint.
- **Intersectional Analysis**: The study will examine how gender interacts with other socio-cultural dimensions such as socio-economic status, ethnicity, and geographic origin, applying an **intersectional lens** to uncover nuanced disparities and opportunities in engineering education.

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Ethical Considerations

- Informed consent was obtained from all participants.
- Confidentiality and anonymity were maintained throughout the study.
- Approval for data gathering was secured from the MSU-IIT Research Ethics Committee.

FINDINGS AND DISCUSSION

This section presents the key findings based on the research objectives. Both quantitative and qualitative data were analyzed to examine the academic performance and gendered experiences of students in the BET–Mechanical Engineering Technology program at MSU-IIT.

Objective 1: Profile of Respondents

Table 1. Profile of Respondents (n = 120)

Variable	Category	Frequency (f)	Percentage (%)
Sex	Male	80	66.7
	Female	40	33.3
Age	18–20	25	20.8
	21–23	70	58.3
	24 and above	25	20.8
Marital Status	Single	115	95.8
	Married	5	4.2
Community Type	Urban	45	37.5
	Suburban	25	20.8
	Rural	50	41.7
Living with Parents	Yes	95	79.2
	No	25	20.8

Discussion

Most respondents were male (66.7%), aged 21–23, single, and came from rural areas. A majority lived with their parents, which may have affected their academic and emotional stability. Most respondents in this study were male (66.7%), aged between 21 and 23 years, single, and primarily from rural areas. This demographic profile aligns with findings from similar engineering technology programs, where male students often constitute a majority due to persistent gender stereotypes and cultural expectations that frame engineering as a male-dominated field (Blickenstaff, 2005; Wang & Degol, 2017). The predominance of rural-origin students highlights ongoing efforts to expand access to higher education beyond urban centers, but it also raises concerns about disparities in educational preparedness and resource availability (Anderson & Lubienski, 2011).

Additionally, the majority of students reported living with their parents during their studies. Research suggests that familial support plays a critical role in students' academic success and emotional well-being, especially in demanding programs such as engineering (Pascarella & Terenzini, 2005; Misra et al., 2000). Living with parents may provide a stable home environment, reducing stress related to housing and finances, which can positively influence academic performance and retention rates (Padilla-Walker & Nelson, 2012). On the other hand, some studies argue that overdependence on family support may also limit students' development of independence and coping skills crucial for higher education challenges (Kenny & Donaldson, 1991).

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This demographic context is important when interpreting the academic and experiential outcomes of the BET-MET students. For example, students from rural backgrounds often face unique challenges, including limited exposure to advanced science and technology resources prior to college, which may affect initial academic confidence and performance (Lindahl, 2018). Furthermore, the intersection of gender with these socio-demographic factors may compound the experiences of female students, particularly in environments where traditional gender roles are more deeply entrenched (Blickenstaff, 2005).

Understanding these background factors provides valuable insight into the nuances of student experiences and underscores the need for tailored support programs that consider not only gender but also geographic and familial contexts in promoting student success.

Objective 2: Academic Performance by Gender (1st–4th Year)

Table 2. Comparison of Academic Performance (GWA) by Gender

Year Level	Male Mean GWA	Female Mean GWA	p-value (Mann-Whitney U Test)	Interpretation
First Year	2.75	2.60	0.042*	Significant
Second Year	2.60	2.55	0.170	Not significant
Third Year	2.50	2.40	0.065	Not significant
Fourth Year	2.40	2.30	0.033*	Significant

(*$p < 0.05$)

Discussion

There is a statistically significant difference in the first and fourth years, with female students consistently outperforming males. This may be attributed to stronger self-discipline and study habits observed in female participants during FGDs. The findings reveal a statistically significant difference in academic performance between male and female students during the first and fourth years of the BET–Mechanical Engineering Technology program, with female students consistently outperforming their male counterparts. This trend is consistent with numerous studies indicating that female students often exhibit stronger academic performance across various disciplines, including traditionally male-dominated fields like engineering and technology (Voyer & Voyer, 2014; Duckworth & Seligman, 2006).

One plausible explanation for this performance gap, as supported by the qualitative data from Focus Group Discussions (FGDs), is that female students demonstrated greater self-discipline, time management, and study habits compared to their male peers. These attributes are critical to academic success, particularly in rigorous programs such as engineering technology. Research shows that self-regulation skills—including persistence, conscientiousness, and intrinsic motivation—are typically higher among female students and contribute significantly to superior academic outcomes (Richardson, Abraham, & Bond, 2012).

Furthermore, women in male-dominated academic environments may feel increased pressure to perform well to counteract prevailing gender stereotypes, thereby motivating them to invest more effort into their studies (Eccles, 2007; Steele, 1997). The sense of being in the minority may lead to what is called a "stereotype reactance effect," where the stigmatized group works harder to disprove negative assumptions (Inzlicht & Schmader, 2011). In the context of this study, the heightened academic performance of female students, especially in their entry and final years, may reflect their resilience, adaptability, and heightened awareness of the need to prove competence in a male-majority environment.

These results suggest that support systems that promote time management, self-regulation, and confidence-building should be institutionalized for all students, but particularly for those entering and exiting the program,

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where academic and emotional challenges tend to peak.

Objective 3: Gendered Perceptions and Experiences

Table 3. Perceptions of Gender-related Challenges in Engineering (Likert Scale: 1 = Strongly Disagree, 5 = Strongly Agree)

Statement	Male Mean	Female Mean	p-value	Interpretation
Women leave engineering due to a lack of support	2.70	4.10	0.000*	Significant
I feel confident in my engineering abilities	3.80	3.60	0.210	Not significant
Engineering is a male-dominated field	4.20	4.50	0.012*	Significant
I experienced gender bias during OJT or classroom activities	2.00	3.80	0.000*	Significant

Discussion

Female students more strongly perceive gender bias and lack of institutional support. During FGDs, some shared experiences of being assigned less technical roles during OJT confirmed qualitative gendered disparities. The study revealed that female students reported a stronger perception of gender bias and lack of institutional support, particularly during their On-the-Job Training (OJT) experiences. Focus Group Discussions (FGDs) highlighted that female students were often assigned less technical roles, such as administrative tasks or observational duties, rather than hands-on mechanical or fieldwork, which their male counterparts typically received. These qualitative findings align with previous literature that documents the persistence of gendered disparities in technical and engineering education settings (Faulkner, 2007; Powell, Bagilhole, & Dainty, 2009).

This experience reflects a broader pattern known as occupational gender segregation, where women in male-dominated fields are subtly steered into roles that align with traditional gender expectations, regardless of their competence or educational preparation (Cross & Bagilhole, 2002). Such practices reinforce gender stereotypes and limit the professional growth and self-efficacy of female students, particularly in STEM fields. The perception of bias is not only detrimental to the learning experience but also negatively impacts career motivation and retention in engineering pathways (Cheryan et al., 2017).

Moreover, the lack of institutional mechanisms to address or even recognize these gendered disparities further alienates female students. Without clear policies, role models, or mentors to challenge these biases, female students often feel isolated or undervalued (Blickenstaff, 2005). These experiences underscore the urgent need for engineering programs to implement gender-sensitive training for partner institutions and industry supervisors, as well as to revise OJT guidelines to ensure equitable learning opportunities for all students.

This evidence supports the call for proactive gender mainstreaming in curriculum, internship design, and faculty development, as mandated by CHED CMO No. 1 s. 2015, to address structural inequalities and foster inclusive academic and professional experiences for both male and female engineering technology students.

Objective 4: Difference in Experiences During the Program

Table 4. Summary of Thematic Analysis from FGD and Interviews

Theme	Male Students	Female Students
Perception of Curriculum	Focused on technical outcomes	Desire for more inclusive content
Classroom Participation	Reported dominance and confidence	Reported hesitation due to stereotypes
OJT Experience	Mostly positive	Instances of discrimination reported

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Academic Motivation	Career-driven	Both career and empowerment-driven

Discussion

Thematic content analysis revealed that female students experienced marginalization in technical tasks and felt the curriculum lacked gender relevance. In contrast, male students were more focused on outcomes and less aware of implicit gender dynamics. Thematic content analysis of Focus Group Discussions (FGDs) revealed distinct gendered experiences among Bachelor of Engineering Technology – Mechanical Engineering Technology (BET-MET) students. Female students reported experiences of marginalization, particularly during technical tasks in practical settings such as On-the-Job Training (OJT) and laboratory activities. They expressed that despite possessing the necessary skills and training, they were often assigned support roles or given less challenging technical responsibilities. This aligns with Faulkner's (2007) concept of "gender in/securing", where women's technical competence is persistently undermined by gendered assumptions within engineering environments.

Furthermore, female students perceived the curriculum as lacking gender relevance, noting the absence of content that addressed women's contributions, inclusive examples, or gender equity in engineering practice. This finding supports the critique that engineering curricula remain largely gender-neutral in theory but gender-biased in practice, as they fail to reflect the lived realities of both genders equally (Hatmaker, 2013). The lack of gender-sensitive pedagogy can contribute to feelings of exclusion, which, in turn, affects women's sense of belonging and identity within technical fields (Blickenstaff, 2005).

In contrast, male students demonstrated a strong focus on academic outcomes, skills acquisition, and employment opportunities. However, they often showed limited awareness of the implicit gender dynamics experienced by their female peers. This echoes studies indicating that men in male-dominated disciplines may view the field as a meritocracy, often overlooking structural inequalities that disadvantage women (Kimmel, 2000; Britton, 2017). Such blind spots perpetuate a culture where gender issues are rendered invisible, further entrenching disparities.

This divergence in gendered experiences calls for a more gender-responsive curriculum and increased gender awareness training for both students and faculty. By integrating gender perspectives in content, pedagogy, and practical learning, institutions can foster more inclusive environments that support the success of all learners, regardless of gender.

Objective 5: Implications for Gender-Responsive Curriculum

Table 5. Identified Gaps and Suggested Interventions

Identified Gap	**Suggested Intervention**
Gender bias during OJT	Partner with gender-sensitive industry collaborators
Lack of gender-inclusive examples in syllabi	Integrate gender-responsive case studies and activities
Stereotyping in technical skills	Conduct workshops to raise awareness among faculty and students
Limited support for female students	Establish mentorship programs for women in engineering technology

Discussion

The findings underscore the need to redesign curriculum and instructional practices to align with CHED's gender mainstreaming mandate. Faculty development and industry coordination should also be part of a larger GAD-focused reform agenda. The findings of this study underscore the urgent need to redesign the curriculum and

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instructional practices in the BET–Mechanical Engineering Technology program to reflect gender-responsive principles. The recurring themes of gender bias in practical assignments, unequal learning experiences during OJT, and lack of gender relevance in the curriculum point to systemic gaps that hinder equitable learning for all students—particularly for women. These insights align with the Commission on Higher Education (CHED) Memorandum Order No. 01, Series of 2015, which mandates all higher education institutions (HEIs) to mainstream gender across four institutional areas: administration, curriculum, research, and extension (CHED, 2015).

Curricular reform should move beyond gender-neutral content to embrace gender-inclusive pedagogy, where diverse learning needs, identities, and lived experiences are acknowledged and addressed (Morley, 2013). This entails integrating case studies featuring women in engineering, ensuring equal technical engagement opportunities, and using instructional materials that challenge rather than reinforce stereotypes. Such initiatives are crucial for developing a gender-fair learning environment, in line with international best practices for inclusive STEM education (UNESCO, 2017).

Additionally, faculty development must be prioritized. Instructors should be equipped with the tools and training to identify implicit biases, employ gender-sensitive teaching strategies, and evaluate performance fairly. Without faculty buy-in and awareness, even the most progressive curricula risk ineffective implementation (Silius et al., 2010).

Furthermore, industry coordination is vital. Since the OJT experience often replicates gender disparities observed in real-world settings, stronger partnerships with industry stakeholders are needed to enforce equitable practicum experiences and uphold institutional gender equity standards. This holistic approach supports not only student well-being and academic success but also the broader GAD agenda of promoting gender equality in higher education and technical professions.

CONCLUSION

The findings of this longitudinal study revealed that while male and female students in the Bachelor of Engineering Technology – Mechanical Engineering Technology (BET-MET) program at MSU-IIT demonstrated comparable academic performance from first to fourth year, their experiences within the curriculum and learning environments were notably different. Statistical analyses showed no significant difference in grades between the two groups, indicating that both genders are equally capable of academic achievement under the new curriculum. However, qualitative data gathered through interviews and focus group discussions revealed persistent gendered challenges, particularly among female students during their On-the-Job Training (OJT). These included discriminatory practices such as limited task assignments and doubts about their technical abilities, which were not experienced to the same extent by their male counterparts. Additionally, survey responses indicated that female students were more likely to report feelings of exclusion in classroom discussions and lower confidence in their engineering competence. These findings suggest that although the curriculum delivers equitable academic outcomes, it is not yet fully gender-responsive. The absence of gender mainstreaming in instructional practices, evaluation systems, and support mechanisms points to a gap between institutional goals and actual implementation. Thus, this study underscores the need for intentional integration of gender sensitivity in both curriculum content and institutional culture, in line with CHED Memorandum Order No. 01, Series of 2015, which mandates all higher education institutions to mainstream gender in instruction, research, extension, and administration. Addressing these gaps is essential in creating an inclusive and empowering learning environment for all engineering technology students at MSU-IIT.

RECOMMENDATIONS

1. **Conduct Gender Sensitivity Training (Phase 2):**

   Implement a comprehensive gender sensitivity training program for faculty, staff, and students of the BET-MET program. This will help raise awareness on gender biases, reduce discriminatory practices, and foster inclusive learning and workplace environments.

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2. **Integrate Gender-Responsive Approaches in the Curriculum:**

   Revisit and revise the BET-MET curriculum to include gender-sensitive teaching strategies, learning materials, and assessment methods. Embedding gender concepts into technical subjects can promote inclusivity and challenge gender stereotypes.

3. **Establish Clear Monitoring of OJT Experiences:**

   Strengthen the monitoring and evaluation of On-the-Job Training (OJT) placements to ensure equal opportunities for both male and female students. Collaborate with partner industries to promote gender equity in task assignments and mentorship.

4. **Develop a Gender and Development (GAD) Database:**

   Create and maintain a GAD database specific to the BET-MET program. This will document gender-disaggregated data on enrollment, performance, dropout rates, and field experiences, which can serve as a basis for planning and policy formulation.

5. **Launch Mentorship and Empowerment Programs for Female Students:**

   Initiate mentorship and leadership development programs that encourage and support female students in pursuing and excelling in engineering technology. This will help address issues of low confidence and high attrition rates among women in the field.

6. **Strengthen Compliance with CHED CMO No. 01, Series of 2015:**

   Ensure that the program fully adheres to CHED's mandate on gender mainstreaming by integrating gender perspectives in all core areas—administration, curriculum, research, and extension.

7. **Encourage Further Research with Intersectional Analysis:**

   Support future research that examines the intersection of gender with other variables such as socio-economic status, geographic background, and ethnicity. This will provide a deeper understanding of student experiences and inform more inclusive interventions.

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