From Policy to Participation: Gendered Classroom Dynamics in Stem Higher Education

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Abstract: This article examines the discursive practice of gender equality policies within the classroom setting of higher education, and how gender equality operations influence the participation, engagement and access to educational and career directions of students, especially in STEM fields. With the applied linguistic approach, it explores the intersection of gender with other forms of social divisions, such as academic discipline, institutional status and linguistic background to determine how these factors can affect classroom dynamics in both technology-based and lecture-based university classes. Using a mixed-methods approach, the study integrates student comments from the European University of Armenia and Yerevan State University with interactional and corpus-assisted analysis of classroom speech and critical discourse analysis of institutional gender-equality policy texts. In this way, both macro-level policy intentions and micro-level classroom interactions can be studied and allow understanding the holistic picture of how institutional directives are applied into the everyday teaching and learning practices. The article is aimed, in particular, at studying whether and how the inclusive policy language is implemented in classroom participation, authoritative and expertise negotiation, development of academic confidence and sense of belonging within students. The results indicate that there is an overlap that occurred over the years between the language of policy texts and the discursive realities of classrooms. In many ways, policies emphasize gender equity, but the dynamics in classroom often stifle subtle gendered and disciplinary hierarchies that define who speak, what is valued and how students see themselves as having the potential to participate in STEM disciplines. Compounded barriers to full engagement are frequently faced by non-native speakers, women and nontraditional students with regard to their enrollment status, which underscores the relevance of intersectional analysis. The article elucidates the primary place of language in mediating gender educational experiences. It puts forward intersectionally enlightened and linguistically focused pedagogical and policy practices that reflect the intricate relationship among identity, discipline, and classroom dynamics. The results show that meaningful equity in higher education cannot be achieved only by focusing on the design of the institutional policies but also by considering the daily interactions in which authority, participation and belonging are practiced.

Keywords: Gender equality, Higher education, STEM, Policy implementation, Student participation, Applied linguistics

1. Introduction

The issue of gender equity in tertiary education has been consistently identified as one of the urgent objectives, especially in the area of Science, Technology, Engineering and Mathematics (STEM) where women and other marginalized individuals are underrepresented (Blickenstaff, 2005; UNESCO, 2021). Gender equality policies have been introduced in institutions all over the world with a view of minimizing structural obstacles, ensuring inclusive participation and encouraging different scholarly opportunities. Such policies commonly focus on equal opportunities, equal assessment and facilitating learning conditions. However, there is an indication that the translation of such policy goals into classroom practices is not even, and there are still gaps in participation, engagement and achievement (Ro et al., 2022; Reinking and Martin, 2018).

Although macro-level policy documents encourage inclusivity, micro-level classroom interactions are crucial in shaping student' educational experiences. These gendered and disciplinary hierarchies may be strengthened or disrupted through participation in classroom discourse, authority negotiation and expert identification. In STEM education, it has been found that women can contribute less to the discussion, get less positive feedback and have subtle biases in their interactions with teachers and classmates (Bian et al., 2017; Cheryan et al., 2015). These trends not only affect short-term engagement but also academic confidence, sense of belonging and career goals in the long term. Although there has been an increasing interest in gendered dynamics in higher education, there are few researches with gap bridging between the policy discourse and the classroom interaction. Much of the existing literature examines policies or pedagogical practices in isolation, without sufficient attention to how institutional directives are interpreted, mediated, or resisted in everyday teaching contexts. Moreover, gender is frequently treated as a singular category, overlooking its intersection with academic discipline, institutional status, and linguistic background.

The present research addresses these gaps by adopting an intersectional applied linguistics approach that integrates critical discourse analysis of institutional gender equality policies, corpus-assisted and interactional

analysis of classroom discourse, and student self-reports. This approach enables systematic examination of both macro-level policy texts and micro-level classroom practices, highlighting how language mediates inclusion, power, and participation. By analyzing policies alongside classroom interaction, the study examines whether institutional commitments to equity are enacted, mediated, or undermined in everyday pedagogical practice within STEM higher education.

Therefore, the principal research question is: How do institutional gender equality policies get implemented, meditated or undermined in the context of classroom discourse and participation practices in STEM higher education. To address this general question, the present study is designed based on the following sub-questions:

1. What is the linguistic representation of the policies that govern gender equality in higher educational institutions, and in what type of discursive means are inclusion policies promoted?
2. What are the ways classroom dynamics re-enact, re-interpret or oppose the intentions of these policies, especially in technology- and lecture-based STEM courses?
3. How do the students view and feel the effects of classroom discourse on their participation, a sense of belonging, and academic goals?
4. In what ways are intersecting social categories, including gender, discipline, institutional status, and linguistic background, useful in determining how policy and classroom experiences are realized?

By connecting institutional policy discourse with classroom interaction and student perspectives, this study contributes to applied linguistics and higher education research by demonstrating how equity is negotiated in practice. The findings aim to inform linguistically sensitive and intersectionally informed pedagogical and policy approaches that support more inclusive learning environments in STEM and beyond.

2. Literature Review

2.1 Gender Equity in Higher Education and STEM

The issue of gender equity in higher education (especially in STEM fields) has been long-standing among policymakers, educators and researchers. The gender differences in the enrolment and career progression have been long-established, female students continue to be underrepresented in the fields of engineering, computer science, and physics (Blickenstaff, 2005; Miller and Wai, 2015; UNESCO, 2021). Empirical studies prove that these differences are not merely the result of individual choice but determined by structural restrictions, cultural practices and instructional interaction on the classroom level (Cheryan et al., 2015; Reinking and Martin, 2018). Observations of STEM learning environments have shown that disparities in access to speaking time, unequal instructor feedback, gender expectations of competence, stereotype threat and implicit bias all have a systematic impact on student confidence, academic self-concept, and career aspiration with marginalization of female students and other underrepresented groups (Sadler et al., 2012; Murphy et al., 2007; Steele and Aronson, 1995; Bian et al., 2017). Consequently, colleges and universities have started to implement gender equality policies that have enabled them to offer inclusive learning spaces, provide equitable access to the available resources, and assist underrepresented groups via their fair evaluation practices, mentoring, and career development programs (Ro et al., 2022). Nonetheless, studies always point towards the disjuncture between the policy development and the classroom implementation. Although macro-level policies express the promises of inclusion and equity, the actual practice of teaching and learning is still influenced by highly socialized processes that may reproduce the hierarchies existing (Reinking and Martin, 2018).

2.2 Policy Discourse and the Micro-Macro Gap

The applied linguistics and higher education policy studies have focused on how language creates social realities and mediates power relations. The critical discourse analysis (CDA) has been extensively used to analyze the way in which institutional policies position gender and inclusion issues (Fairclough, 2003; Lazar, 2005). Studies indicate that policies can be written in broad and idealistic terms but can still be ambiguous about strategies of implementation and thus can be subject to interpretation in classroom situations (Downes et al., 2024). The gap between the intentions of the institutions and classroom enactments is known as the macro-micro gap. To illustrate, STEM education studies indicate that the implementation of policies promoting participatory instruction can be unequally executed and that the participants of teaching can subconsciously support some student groups or certain types of communication, thus reproducing gendered norms (Cheryan et al., 2015; Murphy et al., 2007).

2.3 The Discussions in the Classrooms, Power and Participation

One of the primary platforms of negotiating authority, expertise and participation is the classroom discourse. Research has indicated that gendered patterns are manifested in the speaker, evaluation of ideas and placement of students during a discussion (Holmes and Stubbe, 2015; Thorne, 1993). Lecture-based STEM courses are notorious in terms of the questioning strategies of the instructors, peer interactions and the turn taking where the voices which are more assertive or traditionally dominant are often attributed to male students. Such implicit types of inequality may influence the involvement, self-efficacy and academic functions of students (Sadler et al., 2012). Technological studies in learning settings are another level of complexity. Digital platforms, code laboratories and collaborative tools afford participation, yet are also indicative of existing social inequalities. As an example, women students might be less likely to volunteer their response or be in charge of a group project because of perceived or internalized norms (Cohoon, 2001; Margolis and Fisher, 2002).

2.4 Intersectionality Research in Higher Education

Intersectionality is an original concept developed by Crenshaw (1989) that has evolved into a crucial model of the intersection of two or more social identities, including gender, race, class, language background and institutional status in creating specific privilege or disadvantage. Intersectional approaches to higher education demonstrate that gender does not completely describe the disparities in participation or academic success. To illustrate, females that belong to underrepresented ethnic groups or do not speak English as a first language can encounter some of the additional barriers in STEM classrooms (Museus & Liverman, 2010; Ong et al., 2011). Recent researches that combine intersectionality and applied linguistics focus on how language mediates these experiences (Piller, 2025). Classroom talk, practice in assessment and peer relationships can vary in their impact on students based on the overlapping identities of students.

3. Methods

3.1 Participants

The participants of the study included students and instructors of two higher education institutions in Armenia, namely, Yerevan State University and the European University of Armenia, both of which have STEM programs. There were 120 undergraduate students (65 female students and 55 male students) studying engineering, computer science and physics courses offered in both lecture based and technology enhanced methods. The student cohort reflected diversity in linguistic background (native and non-native speakers of the language instruction). Also, 12 tutors who delivered these courses were included in the study and this was a diversity of disciplinary background and teaching experience. Students were selected using purposive sampling to ensure representation across gender, discipline, linguistic background and enrolment status. Participation was voluntary and students were recruited from courses in which gender equality policies were formally applicable at the institutional level.

3.2 Materials

The materials to be analyzed were divided into three categories:

Policy documents. Policy documents of institutional gender equality, strategic plans and official guidelines were gathered by the participating universities.

The policies were selected based on three criteria: (1) explicit reference to gender equality or inclusion, (2) formal adoption at the institutional level and (3) relevance to teaching, assessment or student participation.

Classroom records. Some of these records were audio and video records of classroom sessions such as lectures, laboratory sessions and group work to record real time classroom interactions. The analysis of classroom discourse via 60 hours was conducted. The recorded lessons were selected to represent different pedagogical formats (large lectures, laboratory sessions and group-based activities) and different STEM disciplines in order to capture variation in interactional dynamics.

Student reflections. The participants were given written reflections about their experiences in the classroom, their perceptions regarding their inclusion and participation, and how the teaching practices affected their engagement and academic confidence.

3.3 Procedures

The research was based on a sequential mixed-methods design. In the first step, institutional policy documents were gathered and analyzed using critical discourse analysis to identify themes, language patterns and discursive

approaches related to gender equity. The next step involved recording classroom interactions over one semester across a range of class formats and teaching styles. Lastly, students were asked to write reflective essays regarding their classroom experiences, particularly in relation to participation, sense of belonging, and perceived barriers or supports. Student reflections were collected using a semi-structured written script consisting of open-ended prompts.

3.4 Data Collection and Analysis

Data analysis combined qualitative and quantitative approaches. Critical discourse analysis (Fairclough, 2003) was used to analyze policy texts to find out the linguistic representations of inclusion and equity. Recordings in classrooms were translated and the analysis of those were based on the corpus-assisted discourse analysis to reveal the patterns of participation, turn taking, questioning and feedback. There was interactional analysis of the negotiation of authority, expertise and participation with consideration of finer gendered and disciplinary interactions. The thematic coding of student reflections was used to define the perceptions of inclusion, confidence and an impact of classroom practices on academic pathways. The combination of these three sources of data into triangulation made it possible to have an overall picture of the operations of the macro-level policies to be enacted or challenged on the micro-level, i.e., classroom interaction. Special care was put on intersectional factors, in which gender, lingual background and institutional status were intersected to influence the experiences of the students. Ethical factors such as confidentiality of the participants, voluntary participation, and anonymization of the data were strictly followed during the study.

4. Results

The article examines the effectiveness of gender equality policies in higher education STEM classrooms, in terms of classroom talk, the participation patterns and the perceptions of students. The data included in policy documents, recordings of classes and student reflections were analyzed to answer the research questions. The findings are put into three sections, namely (1) policy discourse, (2) patterns of interactions in classrooms, and (3) student reflections.

4.1 Policy Discourse Analysis

It entailed the critical discourse analysis of institutional gender equality policy documents in two universities. The analysis has revealed repetitive discursive strategies that are meant to propagate the inclusion. In both institutions, the policy has always focused on the guidelines of equal opportunity, representation and the establishment of supportive learning environments.

Table 1 summarizes the frequency of key discursive strategies identified in the institutional gender equality policy documents, along with illustrative example phrases.

Table 1: Frequency of Key Discursive Strategies in Policy Documents

Strategy	Frequency	Example Phrase
Inclusive pronouns	48	“All students are encouraged to…”
Action-oriented verbs	36	“The university supports equitable…”
Hedging/vague implementation	22	“Faculty should consider, where possible…”

Although the expressed policies were clear in terms of the expression of the institutional commitment to equity, the ambiguity on the issues of enforcement or monitoring indicated that the operationalization might include gaps. It is important to note that STEM-specific instructions were scarce and the majority of the sources were focused on broader concepts of teaching, providing significant interpretative opportunities to the instructors.

4.2 Classroom Interaction Patterns

The classroom interaction analysis reveals a complex relationship between stated institutional commitments to equity and the everyday realities of participation in STEM classrooms. While some interactional practices aligned with inclusive policy goals, others systematically reproduced gendered and intersectional hierarchies. The findings are presented as interconnected patterns rather than isolated phenomena, highlighting how participation, authority, and identity are jointly constructed through classroom discourse. Analysis of 60 hours of classroom recordings revealed three main findings.

Participation Inequalities: Male students spoke 58% of the time in lecture-based classes, compared with 42% by female students. In technology-based lab sessions, participation was more balanced (52% male, 48% female) but remained skewed when instructors addressed conceptual questions.

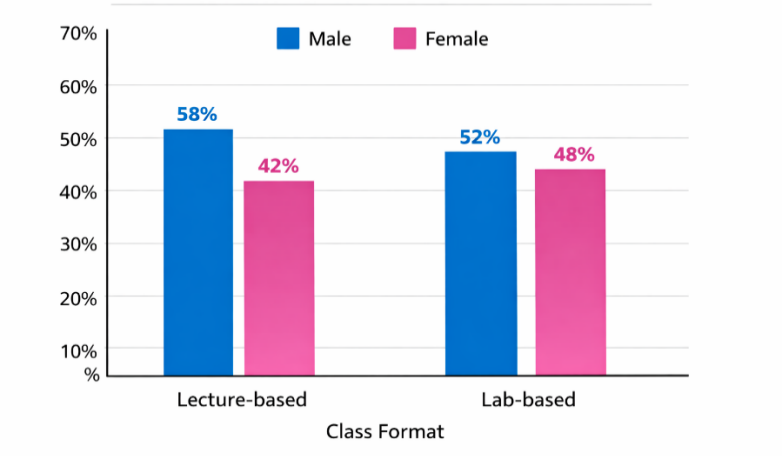

Figure 1: Participation by Gender across Class Formats

Turn-Taking and Authority Negotiation: Instructors often directed technical questions toward male students, particularly in larger lecture courses. Female students were more likely to be interrupted or receive delayed feedback. This was also evident in peer interactions where male students tended to become the leaders in group work whereas female students tended to be more reserved.

Table 2: Interaction Patterns by Gender

Interaction Type	Male Students	Female Students
Initiated Questions	64%	36%
Responded to Instructor	60%	40%
Peer-led Contributions	62%	38%

Intersectional Observations: The non-native speakers, especially female students, were also less represented both in the lecture and lab settings. High-stakes discussions were implicitly restricted to students with a part-time status of enrollment or prior limited experience in STEM. In general, these results suggest that gendered involvement is compounded with linguistic background, enrollment and disciplinary norms. Although these trends are not entirely reflected in formal policies that encourage inclusion, they are indicative of existing gaps between institutional desires and classroom practices.

4.3 Student Reflections

Student reflections are presented using a consistent first-person analytical stance and are interpreted in relation to policy discourse and classroom interaction patterns.

Thematic analysis of 120 student reflections revealed three themes that were most common when it came to inclusion, confidence and suggestions on how to enhance equity in the classroom.

Perceptions of Inclusion and Belonging: The existence of institutional policies that encouraged equity was admitted by many students yet they stated that the experiences in classrooms were not always in line with the stated principles. Non-native and female students often mentioned that they felt neglected or shy to ask any questions, despite the direct encouragement of the instructor. Certain students reported that group work tended to support pre-existing participation inequalities with more outspoken individuals domineering the disparate discussions. Some students actually commented on the less obvious kinds of marginalization, like being given less conspicuous work when working on group projects or being ignored in big lecture classes.

> *Selected Student Reflection Excerpts: "Even when policies say everyone can participate, I still feel ignored in lectures."*

"In group tasks, I often end up taking notes while others lead the discussion, which makes me feel invisible."

Impact on Confidence and Academic Pathways: Students stated that they felt subtle gendered hierarchies and dynamics in classrooms affected their self-confidence levels and desire to take up higher-level STEM classes. A number of female students mentioned that peer relationships and what they believed to be preferred by their instructors influenced their choices of majoring in certain STEM sub-disciplines. Male students can also note such dynamics and they saw that female peers did not always ask questions or take the lead on something. Non-native speakers also pointed to the further difficulty of engaging in high-stakes conversation because of language barriers, which were also compounded by gendered expectations.

Selected Student Reflection Excerpts: "I hesitate to ask questions in labs because male students always dominate discussions."

"I decided against taking an advanced physics course because I didn't feel confident speaking up in class."

Recommendations from Students: Students suggested establishing explicit classroom norms, structuring peer collaboration more deliberately and using inclusive questioning strategies. Several students emphasized the importance of instructors rotating questions systematically and actively inviting contributions from quieter participants. Others suggested workshops or guidance on group dynamics to ensure that all voices are heard in collaborative settings.

Selected Student Reflection Excerpts: "It would help if instructors rotated questions more deliberately."

"Structured group roles would make it easier for everyone to participate."

Taken together, the quantitative participation data and qualitative student reflections reveal that disparities in classroom talk are not merely numerical but experiential. Patterns of unequal turn-taking and feedback were mirrored in students' reported feelings of hesitation, invisibility and reduced academic confidence. These converging findings strengthen the argument that classroom discourse functions as a key mechanism through which gender equality policies are either enacted or undermined in practice.

5. Discussion

This paper has analyzed the interplay of the gender equality policy, classroom practice and student experience in the higher education STEM setting and the core hypothesis that whereas institutional policy advances the principles of inclusiveness, the practices within classrooms tend to reproduce micro gendered and disciplined hierarchies that dictate student access, confidence and academic trajectories. The results give understanding of the multifaceted connection among macro-level policy motivations and micro-level classroom implementations with the primary focus on the central standing of language in mediating equity.

5.1 Disconnect Between Classroom Practice and Policy

The analysis of institutional gender equality policy showed some aspirational language of inclusion, equal opportunity and support of all students. Inclusive pronouns and action-oriented verbs were common in the policies, and this indicated the institutional belief in equity. But there was a lack of clarity in implementation directions, which was typical in all the documents, indicating that there was a mismatch between stated goals and action plans. This is consistent with the previous studies that have revealed that the language of the policies tends to express ideals without defining how the same can be implemented in everyday teaching activities (Downes et al., 2024; (Ro et al., 2022). Although there were policy guidelines on equal participation, male students could always make more speeches during lecture-based classes, had higher chances of being addressed by instructors, and led in the interactions with other students. Female and non-native learners tended to be more careful, which is in line with the studies showing that even policy objectives can be put at risk through the hierarchies inherent to the classroom and the implicit biases (Bian et al., 2017; (Cheryan et al., 2015). Such results help to reveal the stability of the implicit gendered norms that are not discussed directly in the policy documents implying that macro-level intentions will be not enough to ensure micro-level equity.

5.2 Intersectional Dynamics of Participation and Engagement

The intersectional nature of this study is one of the most important contributions as it emphasizes the interaction between gender and linguistic background, enrollment status and prior experience to influence classroom participation. The non-native speakers, especially females, were less likely to volunteer an answer or

participate in activities led by peers. Students who had limited previous STEM experience or were part-time students also had difficulties with making participation claims. These findings are reminiscent of earlier studies reinforcing the complicated nature of the data on obstacles that students in having multiple marginalized statuses encounter (Crenshaw, 1989; Museus and Liverman, 2010; Ong et al., 2011). Although it was clear that the males dominated the lectures, the success was not equal among all the male students, the non-native or part-time male students were no longer than females in taking part in lectures. This subtle insight explains why it is crucial to take into account various axes of identity when designing policies and interventions in the classroom, and leave behind the simplistic male/female dichotomy to comprehend participation and engagement comprehensively.

5.3 Contextual Mediation: Lecture vs. Lab Environments

Smaller, technology-based lab sessions were found to have a more balanced participation compared to large lectures. Labs were offering opportunities to work together and get regular feedback on instructors, minimizing engagement barriers. This observation is consistent with the previous studies proving that classroom layout, collaborative learning models, and interactive instructions have the potential to alleviate gendered difference (Cohoon, 2001; Sadler et al., 2012). It also implies that policy implementation is context specific: although the overall institutional guidelines determine the goals, the micro context of the classrooms determines the realization of the inclusive practices.

5.4 Language as a Mechanism of Inclusion and Exclusion

The linguistic analysis of the study highlights the importance of using language as a mediating power, authority, and participation. The classroom talk indicated that the negotiation of authority takes place based on turn-taking, questioning and feedback patterns that may either support or disrupt the hierarchies. Male students were often placed as official contributors whereas female and non-native students more often encountered the delay in feedback or disruption. These results can be compared with the study by Holmes and Stubbe (2015) on gendered workplace talk and that by Thorne (1993) on classroom talk, which indicate that even in supposedly inclusive environments, the reproduction of inequities can be done through the subtly linguistic patterns. Policy language and classroom interaction, therefore, are interconnected locations, which negotiate, contest and perform equity.

5.5 Academic Confidence and Career Pathways Implications

Student comments showed that classroom engagement patterns had concrete implications to confidence and academic paths. Female students would often cite the reluctance to attend higher-level STEM classes or leadership in group activities as a result of feeling excluded or their value was underrated. The same concerns raised by non-native speakers who stated that language proficiency overlaps with gendered norms to determine self-efficacy. These findings are consistent with previous findings on stereotype threat and self-concept in STEM education (Steele and Aronson, 1995; Margolis and Fisher, 2002), with respect to their long-term consequences on career goals and educational opportunities.

6. Conclusion

This paper discussed how gender equity could be applied in higher education STEM classrooms on the intersectional and linguistic aspects of participation, power and opportunity. By combining critical discourse analysis of institutional policies with corpus-assisted and interactional analyses of classroom discourse and student reflections, it highlights how macro-level directives interact with micro-level experiences to shape equity outcomes. Although the institutional documents encourage inclusiveness, there is a tendency to have implicit hierarchies that favor the male and native-speaking students affecting the participation, confidence and academic progress. An intersectional approach reveals that gender can respond to language background, enrolment status and prior STEM exposure, which have compounded effects, and female non-native speakers, in particular, felt marginalized demonstrating the need for policies that address multiple, overlapping identities. These dynamics are further mediated by classroom context and pedagogy. Smaller, technology-enhanced lab classes facilitated a more equal participation process compared to large lectures, and language turned out to be a prime demonstration of power and belonging, which explains a need to focus on linguistically responsive pedagogy. The practical implications suggest developing intersectionally and linguistically sensitive policies, training faculty to recognize and mitigate subtle hierarchies, introducing structured classroom practices such as equitable turn-taking and purposeful questioning, and designing instruction to encourage participation among students of different backgrounds. A coordinated action of policy, pedagogy and classroom discourse results in

the creation of equity. The study bridges macro-level guidelines and micro-level interactions offering practice-based learning in higher education and STEM studies. Future studies may include longitudinal research, different disciplines or institutional contexts and evaluate interventions aimed at closing the gap between policy intent and classroom practice. Such work would strengthen evidence-based strategies for inclusive education.

Ethics Declaration: This article involved human participants. Ethical approval was obtained from the European University of Armenia and Yerevan State University. Written consent was obtained from all participants for both participation and publication with anonymity and confidentiality fully maintained.

AI Declaration: The authors declare the use of artificial intelligence, specifically Grammarly and QuillBot, solely for spelling, grammar and language refinement. These tools did not influence the study design, data analysis, interpretation of results or conclusions.

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