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De-Genderizing STEM Disciplines

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ABSTRACT

This study examines the concept of genderization within STEM (Science, Technology, Engineering, and Mathematics) disciplines and proposes a conceptual framework for classifying disciplinary processes as masculine, feminine, or neutral. Using a conceptual analytical approach, the research evaluates key organizational and operational characteristics, including structure, communication, training, and decision-making processes. Two representative disciplines – Physics and Software Engineering – are analyzed to illustrate how gendered characteristics manifest across different stages of disciplinary practice. The findings suggest that STEM activities are not inherently masculine but instead demonstrate a dynamic combination of structured and collaborative attributes. The study contributes to ongoing discussions on gender representation in STEM by challenging traditional perceptions and highlighting the importance of inclusive educational and organizational practices.

Keywords: Degenderization, STEM disciplines, Gender characterization, Software engineering, Physics

INTRODUCTION

Gender is a concept that extends beyond the biological distinction between males and females. In social science and organizational research, gender is often understood as a set of attributes, behaviors, and expectations that influence how individuals, institutions, and disciplines function (Mill, 1988; Acker, 1990). Organizations and processes themselves often exhibit gender-related characteristics such as hierarchical structure, communication patterns, and modes of decision-making. These attributes can be perceived as masculine, feminine, or neutral depending on how they reflect commonly associated behavioral patterns. The concept of gendered organizations has been extensively examined in organizational and social theory. Early research suggests that institutions and processes may embody gendered characteristics that reflect broader social norms and expectations (Calas & Smircich, 1992; Acker, 1990; Acker, 1992; Alvesson & Billing, 1992). These perspectives emphasize that gender is not only a property of individuals but is embedded within organizational structures, practices, and knowledge systems.

Additional studies have explored gendered organizational behavior and structural dynamics in different institutional contexts, highlighting how work styles, network structures, and social roles may reinforce gendered patterns within organizations (Britton, 2000; Browne, 2000; Vlassoff & Moreno, 2002; Manvill, 1997). These perspectives extend the understanding of gender beyond individual characteristics to include institutional practices and social systems.

The disciplines that fall under STEM – Science, Technology, Engineering, and Mathematics – are traditionally perceived as male-dominated fields. Historically, engineering and technological professions have been associated with masculine characteristics such as rigid structures, strict adherence to rules, and strong hierarchical communication systems (Acker, 1992; Alvesson & Billing, 1992). However, many processes within STEM disciplines actually demonstrate characteristics that align with collaborative, flexible, and networked forms of work, which are often associated with feminine organizational traits.

Increasing the participation of women in STEM fields is critically important for both social and economic development. Women represent a significant portion of global talent, and their underrepresentation in STEM limits the diversity of perspectives that drive innovation and scientific advancement. Research has shown that inclusive participation improves creativity, problem-solving capacity, and overall productivity within scientific and technological communities (Dasgupta & Stout, 2014; Cheryan et al., 2017). Despite these benefits, cultural stereotypes and gender biases continue to influence educational choices and career paths, discouraging many women from pursuing STEM careers.

The primary objective of this study is to examine the concept of genderization within STEM disciplines and to explore how disciplinary processes may be characterized as masculine, feminine, or neutral. By analyzing the organizational structures and processes involved in STEM fields, this paper aims to highlight the genderized characteristics present in these disciplines and to demonstrate how these perceptions may influence participation patterns. Understanding these dynamics can help challenge stereotypes and encourages more inclusive educational engagement in STEM education and professions.

LITERATURE REVIEW

Scholars in organizational theory and gender studies have long examined how institutions and professional environments exhibit gendered characteristics (Mill, 1988; Calas & Smircich, 1992). These studies suggest that organizations often unconsciously reproduce social gender norms through their rules, practices, and leadership styles (Acker, 1990; Acker, 1992).

Further research has explored genderization in a variety of social and institutional contexts. Manvill (2009) examined gendered dimensions of religious and social processes, while Wilson (2003) analyzed gender differences in learning and success in computer science education. Studies presented by Bendl and Kállai (2007) and Bendl (2008) provide additional insights into gendered learning patterns, particularly in software engineering and mathematics education.

Earlier contributions have also examined gendered organizational logic and learning environments in management and education contexts (Bendl, 1999; Bendl & Kállai, 2007). Research in computer science education further emphasizes differences in learning strategies, confidence levels, and participation patterns across genders (Wilson, 2003). These findings support the argument that gendered perceptions are embedded in both institutional structures and educational processes.

Research on gender bias in STEM has also gained significant attention. Numerous studies have documented the underrepresentation of women in many STEM disciplines, particularly in fields such as physics, engineering, and computer science (Moss-Racusin et al., 2012; Reuben et al., 2014). Biases may appear in multiple forms, including stereotypes about intellectual ability, lack of visible role models, and structural barriers within academic and professional environments. These factors influence both entry into STEM programs and long-term career progression.

The presence of role models has been identified as a critical factor in shaping participation in STEM disciplines. Exposure to successful female scientists and engineers can positively influence students' self-perception and career aspirations. Research shows that representation not only increases interest in STEM but also strengthens persistence by reinforcing a sense of belonging (Lockwood, 2006). Conversely, the absence of visible role models may contribute to the perception that STEM fields are not inclusive, thereby discouraging participation among underrepresented groups.

The role of media representation and public discourse has also been identified as a significant factor influencing gender perceptions in STEM. Studies highlight that limited visibility of female role models in scientific communication and media narratives may contribute to lower participation among women (Kitzinger et al., 2008; Hill et al., 2010). Online initiatives such as BiasWatchNeuro further demonstrate the importance of monitoring representation in academic environments and promoting inclusivity.

Another important factor influencing gender disparities in STEM is the phenomenon of stereotype threat, which refers to the risk of confirming negative stereotypes about one's social group. Research demonstrates that even subtle reminders of gender stereotypes can negatively affect performance and confidence among women in mathematics and science contexts (Spencer et al., 1999). These effects are not related to actual ability, but rather to psychological pressure and situational context. Addressing stereotype threat requires creating supportive environments that emphasize growth, competence, and inclusivity.

Empirical research on implicit bias has further demonstrated the persistence of unconscious gender associations in scientific and professional contexts (Nosek et al., 2002; Nosek et al., 2009). These biases influence perceptions of competence and suitability, often reinforcing existing disparities in STEM participation.

Belonging uncertainty has also been identified as a critical factor affecting persistence in academic environments. Individuals from underrepresented groups may experience chronic uncertainty about whether they belong in a given field, which can reduce motivation and long-term engagement. Experimental studies have shown that even brief interventions addressing belonging can significantly improve academic outcomes (Walton & Cohen, 2007). This suggests that relatively small changes in institutional messaging and support structures can have substantial impacts on participation and retention in STEM disciplines.

Gender disparities in STEM are often described through the concept of the "leaky pipeline," which refers to the gradual loss of women at successive stages of education and career progression. Research indicates that structural barriers, institutional practices, and cultural expectations contribute to this phenomenon, limiting long-term retention in STEM fields (Hill et al., 2010).

These barriers include unequal access to opportunities, implicit bias in evaluation processes, and the lack of supportive professional networks. Addressing these systemic issues requires interventions at multiple levels, including education, policy, and organizational culture.

Educational environments also play a crucial role in shaping gender perceptions of STEM disciplines. Classroom dynamics, teaching styles, and peer interactions may reinforce or challenge existing stereotypes about gender and intellectual ability. Research has shown that girls' self-concept in subjects such as physics is particularly sensitive to classroom context and teacher expectations (Kessels & Hannover, 2008).

Stereotype threat and subtle signaling within learning environments can negatively affect performance and motivation, even among highly capable students. These effects contribute to long-term differences in academic confidence and career aspirations, reinforcing gender imbalances in STEM fields (Moss-Racusin et al., 2012).

Persistence in STEM disciplines is also influenced by students' attitudes toward science and engineering as fields of study. Research suggests that differences in persistence rates between men and women are often linked to variations in perceived relevance, interest, and social support (Wyer, 2003). Women are more likely to leave STEM pathways when they encounter environments perceived as unwelcoming or incompatible with their values.

These findings emphasize that gender disparities are not solely the result of ability differences, but rather reflect complex interactions between individual motivation, institutional culture, and broader societal expectations.

Recent scholarship has increasingly focused on identity formation and intersectionality in STEM participation. Carlone and Johnson (2007) introduced a framework for understanding science identity among women, while Ong, Smith, and Ko (2018) examined how race, gender, and class intersect to shape experiences in STEM fields. These perspectives highlight the importance of considering multiple dimensions of identity when analyzing participation patterns.

A growing body of research highlights the importance of identity formation in shaping participation in STEM disciplines. In particular, engineering and science identity have been shown to significantly influence students' academic choices, persistence, and career trajectories. Individuals who perceive themselves as competent and recognized members of a scientific community are more likely to pursue and remain in STEM fields (Carlone & Johnson, 2007; Godwin et al., 2016). Identity is constructed through interactions with educational environments, role models, and peer groups, and is strongly affected by social expectations and cultural norms.

Studies indicate that women are less likely to develop a strong STEM identity when they experience environments that do not align with their self-perceptions or values (Godwin et al., 2016; Ong et al., 2018). This process is further complicated by implicit biases and the lack of visible representation, which can reduce self-efficacy and belonging. Therefore, understanding identity formation is essential for interpreting gender disparities in STEM participation.

Another important area of research focuses on gendered organizational structures. Acker's theory of gendered organizations argues that institutional processes often reinforce gender hierarchies through implicit assumptions about leadership, productivity, and work culture (Acker, 1990; Ridgeway, 2011).

Similarly, studies in science education show that learning environments and disciplinary cultures may subtly discourage women by presenting STEM as inherently masculine.

Research in computing and engineering has also emphasized the role of organizational culture in reinforcing gender dynamics. Margolis and Fisher (2002) documented structural and cultural barriers in computer science education, while Williams et al. (2014) described the emergence of "bro culture" in technical environments, which can discourage diversity and inclusion.

Recent research has also explored how disciplinary practices themselves may carry gendered characteristics. For example, collaborative communication styles, flexible problem-solving approaches, and network-based learning environments have been associated with feminine organizational traits. Recognizing these characteristics within STEM disciplines may help challenge the traditional perception that these fields are inherently masculine (Bem, 1981; Ridgeway, 2011).

The culture of engineering and technical disciplines has also been examined as a key factor in gender disparities. Studies suggest that engineering environments often reproduce masculine norms through language, symbols, and everyday practices, which may discourage participation from underrepresented groups (Faulkner, 2008). These gendered cultural patterns are embedded in both formal organizational structures and informal social interactions.

Recognizing and addressing these cultural dimensions is essential for developing more inclusive STEM environments. By shifting focus from individual deficits to structural and cultural factors, researchers and educators can better understand how gendered dynamics are reproduced within disciplinary practices.

The gender characteristics of organizational structures, processes, and STEM disciplines are summarized in the below Table 1.

Table 1: Characterization of organizational, process and STEM discipline genderization

Issues	Masculine	Feminine	Neutral
Organizational structure	Rigid structures	Flexible structures	Intermediate structures
Nature of processes	Well-documented	Flexible and ad hoc processes	Intermediate processes
Communication mechanism	(deeply) Hierarchical communication	Highly networked communication	Hybrid networked communication
Training mode	Regimented training	Flexible *on-need training*	Mixed training model
Organizational confidence	High organizational confidence development	Organizational confidence is relatively low	Organizational confidence is relatively medium
Adherence to rules, regulations, processes & standards	Strict adherence to rules and regulations	Flexible adherence, often customized to the environment	Both strict and customization possible
Time consciousness	Highly time-conscious activities	Comparatively less time-conscious	Intermediate importance to time
Goal achievement	Focused in achieving finite goals at any one time	Many project goals are linked and well-established	Mixture of goals
Mission success	Success of the mission overrides the feelings of individuals	Feelings and expressions of individuals or groups override the success of mission	Both mission success and individual feelings are considered
Characteristic	Organizers and administrators	Nurturers, servers and	A blend of both behavioral

behaviors		community builders	attributes
Example Organizations	Military, surgical procedures	Hospital, Diplomatic services (foreign affairs and trade)	Football teams, Financial Institutions, Educational Institutions
Example Disciplines of STEM	Science: Theoretical Physics, Physical Chemistry, Botany, etc. Technology: Communication Theory, Engineering: Verification, Validation, etc. Mathematics: Logic, Number Theory,	Science: Applied Mathematics Technology: Biotechnology, most aspects of Information Technology and Information Systems Engineering: Most Engineering disciplines, Mathematics: Statistics	Science: Library Science, Biology, Botany Technology: Information Management, Information Science Engineering: Traffic Engineering, Thermodynamics Mathematics: Applied Statistics, Queuing Theory,

MATERIALS & METHODS

This study adopts a conceptual analytical approach to examine genderization within STEM disciplines. The research is based on the development of a gender classification framework that evaluates disciplinary processes according to several organizational and operational characteristics. These characteristics include organizational structure, nature of processes, communication mechanisms, training modes, adherence to rules and procedures, time consciousness, goal orientation, and mission success.

The classification framework is informed by established theories of gendered organizations and gender schema, which provide a theoretical basis for interpreting masculine, feminine, and neutral characteristics (Bem, 1981; Acker, 1990; Ridgeway, 2011).

Using this framework, disciplinary activities can be categorized into three gender classifications: masculine, feminine, and neutral. Masculine characteristics typically include hierarchical structures, strict rule adherence, time urgency, and goal-focused operations (Bem, 1981; Acker, 1990). Feminine characteristics emphasize collaboration, flexibility, relational communication, and process-oriented work environments. Neutral characteristics represent a balanced combination of both approaches.

To demonstrate the application of this framework, two representative STEM disciplines were selected for detailed examination: Physics and Software Engineering. These disciplines were selected because the genderization criteria can evaluate their multiple stages of analytical and problem-solving processes.

The study analyzes each discipline’s stages to determine how their organizational structures and operational practices correspond to gendered characteristics. The study relies on theoretical interpretation, literature review and observational analysis of disciplinary practices. While the framework provides a structured approach for analyzing genderization, it is primarily conceptual and serves as a foundation for future empirical research

Limitations of the study

This study is conceptual in nature and is based on theoretical interpretation and qualitative analysis of disciplinary practices. Therefore, the findings are not intended to provide empirical generalization but rather to offer a structured framework for future research. Further empirical validation through quantitative studies, surveys, and cross-cultural comparisons is recommended.

RESULTS

The analysis of genderization characteristics across STEM disciplines reveals that different fields and processes exhibit varying combinations of masculine, feminine, and neutral attributes.

The overall gender characteristics of STEM disciplines are summarized in Table 2.

Table 2: Generic genderization issues in STEM disciplines

Issues	Science-A (e.g.,)	Science-B (e.g.,)	Technology	Engineering	Mathematics-A (e.g.,)	Mathematics-B (e.g.,)
Organizational structure	Intermediate & medium structures	Flexible & large structures	Flexible & small structure	Intermediate & medium structures	Intermediate and medium structures	Rigid & large structures
Nature of processes	Intermediate processes	Flexible and ad hoc processes	Flexible processes	Intermediate & flexible processes	Intermediate processes	Well-Documented
Communication mechanism	Hybrid networked communication	Highly networked communication	Highly communicative	Medium communicative	Hybrid networked communication	(deeply) Hierarchical communication
Training mode	Good training is required	Flexible *on-need training*	No formal training mode, expertise is expected	Formal training is very much required	Mixed training model	Regimented training
Organizational confidence	Medium to low, due to no exposure	Organizational confidence is relatively low	Very limited as there are few past projects	Limited experience leads to limited confidence	Organizational confidence is relatively medium	High organizational confidence development
Adherence to rules, regulations, processes & standards	Both strict and customization possible	Flexible adherence, often customized to the environment	Flexibility in application of rules and regulations expected	Good adherence to rules and regulations	Both strict and customization possible	Strict adherence to rules and regulations
Time consciousness	Comparatively less time-conscious	Comparatively less time-conscious	Highly time-conscious activities	Intermediate importance to time	Intermediate importance to time	Highly time-conscious activities
Goal achievement	Mixture of goals	Many goals are linked and taking this into cognizance	Highly focused in achieving few specific goals at any one time	Many goals are linked and taking this into cognizance	Mixture of goals	Focused in achieving all goals at any one time
Mission success	Both mission and success and individual feelings are considered	Feelings and expressions of individuals or groups override the success of mission	Highly critical than individual feelings	Individual feelings important with limited mission success	Both mission and success and individual feelings are considered	Success of the mission overrides the feelings of individuals
Example Projects	Planned development (software upgrades)	Large scale projects (government and military ones)	Gadgets & web-based projects	Medium sized & web-based projects	Small scale government & military projects	Large scale projects (government and military ones) & scientific projects
Inference	Neutral	Masculine	Dominantly feminine	Feminine	Neutral	Dominantly Masculine

The results indicate that certain STEM areas display flexible organizational structures and collaborative communication mechanisms that align with feminine characteristics, while others emphasize hierarchical structures and rigid procedural adherence associated with masculine characteristics (Acker, 1990; Alvesson & Billing, 1992). Some disciplines demonstrate a balanced mixture of both characteristics.

Further analysis was conducted on the stages of Software Engineering, including requirements elicitation, analysis, design, development, testing, deployment, and maintenance. According to the genderization framework, the evaluation was in the following stages.

Table 3: Genderization issues in Software Engineering stages

Issues	Requirements elicitation	Requirements analysis	Software design	Program design
Organizational structure	Has to be flexible	Flexible structures	Pre-defined structures	Structure defined clearly
Nature of processes	Must be consultative	Flexible and ad hoc processes	Intermediate & defined processes	Defined processes
Communication mechanism	Highly interactive	Networked & interactive communication	Hybrid networked communication	Clearly defined
Training mode	Flexible and on-need training is importance	Systematic	Systematic mixed training model	Systematic training
Organizational confidence	Developed thru' team building confidence	Developed thru' team training	Relatively medium confidence thru' teaming	Clearly high degree of confidence
Adherence to rules, regulations, processes & standards	Flexible adherence, often customized to environment	Both strict flexible adherence	Strict, but customization possible	Strict adherence to rules and procedures
Time consciousness	Highly time-sensitive activity, since customer cannot afford undue delays	Comparatively less time-conscious	Rather low importance to time	Correctness is more relevant than time
Goal achievement	Many goals which are linked	Many goals are inter-linked	All goals considered	All goals considered
Mission success	Individual feelings given importance	Feelings and expressions of group dominates	Mission success is solely considered	Mission success is solely considered
Inference	Dominantly Feminine	Feminine	Neutral	Masculine

The results show that early stages such as requirements elicitation and analysis tend to emphasize collaborative communication and flexible processes, indicating feminine characteristics. Later stages such as program design and development demonstrate more structured and rule-based processes.

A similar analysis was performed for the stages of Physics problem-solving processes.

Table 4: Genderization issues in Physics

Issues	Problem formulation	Problem analysis	Solution design (theory)	Solution design (practice)
Organizational structure	Has to be flexible	Flexible structures	Pre-defined structures	Structure defined clearly
Nature of processes	Must be consultative	Flexible and ad hoc processes	Intermediate & defined processes	Defined processes
Communication mechanism	Highly interactive	Networked & interactive communication	Hybrid networked communication	Clearly defined
Training mode	Flexible and on-need training is importance	Systematic	Systematic mixed training model	Systematic training
Organizational confidence	Developed thru' team building confidence	Developed thru' team training	Relatively medium confidence thru' teaming	Clearly high degree of confidence
Adherence to rules, regulations, processes & standards	Flexible adherence, often customized to environment	Both strict flexible adherence	Strict, but customization possible	Strict adherence to rules and procedures
Time consciousness	Highly time-sensitive activity, since customer cannot afford undue delays	Comparatively less time-conscious	Rather low importance to time	Correctness is more relevant than time
Goal achievement	Many goals which are linked	Many goals are inter-linked	All goals considered	All goals considered
Mission success	Individual feelings given importance	Feelings and expressions of group dominate	Mission success is solely considered	Mission success is solely considered
Inference	Dominantly Feminine	Feminine	Neutral	Masculine
Issues	Solution development	Solution testing	Solution analysis	Problem & solution enhancement
Organizational structure	Structure defined ahead of time	Intermediate structure	Well-defined structure	Loose structure
Nature of processes	Well-defined processes	Some processes well-defined, but not all	Well-defined and systematic	Some processes well-defined, but not all
Communication mechanism	Clearly defined	Intermediate communication structure	Clearly defined	Lacks clearly defined communication structure
Training mode	Systematic training	Ad hoc training (limited regularization)	Systematic training	Very limited training
Organizational confidence	High degree of confidence	Limited confidence	High degree of confidence	Low confidence
Adherence to rules, regulations, processes & standards	Well-articulated rules and procedures	Not well-articulated rules and regulations	Strict, but customization possible	Not well-articulated rules and regulations
Time consciousness	Time is important, but adherence to procedures dominates	Time to complete is more relevant than completeness	Highly time-sensitive activity, since customer cannot afford undue delays	Not time sensitive, even though it appears so
Goal achievement	Limited set of goals considered	Limited set of goals considered often	Limited set of goals and planned in advance	No pre-defined goals, but goals come in on-the-fly

Mission success	Mission success and individual feelings are both important	Mission success is more relevant, while some individual feelings considered	Mission success is critical	Individual feelings and environment driven
Inference	Neutral	Feminine	Feminine	Deeply feminine

The findings indicate that the initial stages of physics research often involve collaborative problem formulation and flexible analytical approaches, while later stages emphasize structured methodology and systematic verification.

DISCUSSION

The results of this study highlight how STEM disciplines exhibit a combination of genderized characteristics within their processes and organizational structures. Rather than being strictly masculine or feminine, many STEM activities demonstrate a dynamic blend of collaborative and structured approaches. These findings are consistent with broader discussions on gendered organizational structures and social expectations, which emphasize that gendered dynamics are reproduced not only through institutional frameworks but also through cultural narratives and everyday practices (Browne, 2000; Britton, 2000; Vlassoff & Moreno, 2002).

From a motivational perspective, expectancy-value theory provides a useful framework for understanding gender differences in STEM participation. According to this model, individuals' choices are influenced by their expectations of success and the value they assign to a given activity. Research indicates that gender differences in STEM participation are partly driven by variations in perceived competence and the subjective value of STEM careers (Eccles, 1994). These perceptions are shaped by socialization processes, cultural norms, and educational experiences, further reinforcing gendered patterns of participation.

These findings are consistent with prior research suggesting that gendered perceptions of disciplines are shaped by social expectations, institutional practices, and implicit biases (Moss-Racusin et al., 2012; Cheryan et al., 2017). They also align with studies highlighting the importance of inclusive environments and representation in improving participation and retention in STEM fields (Dasgupta & Stout, 2014; Reuben et al., 2014). Gender differences in technology adoption and interaction patterns have also been observed in organizational contexts (Venkatesh et al., 2000).

One significant implication of these findings is that the traditional perception of STEM disciplines as inherently masculine may not accurately reflect the nature of the work involved (Cheryan et al., 2017; Dasgupta & Stout, 2014). Many stages of scientific and technological processes involve teamwork, communication, adaptability, and relational problem solving – qualities commonly associated with feminine organizational styles.

Understanding these dynamics has important implications for improving women's participation in STEM fields. If educational institutions and professional organizations highlight the collaborative and inclusive aspects of STEM work, they may help counter stereotypes that discourage female students from entering these disciplines.

Gender perceptions also play a critical role in shaping career aspirations and educational choices (Moss-Racusin et al., 2012; Ridgeway, 2011). Cultural narratives, social expectations, and media portrayals often reinforce the idea that STEM is better suited for men. Challenging these perceptions requires both institutional changes and broader awareness of the diverse skills involved in STEM professions.

From an educational perspective, integrating gender-inclusive teaching practices and providing visible role models can significantly improve participation rates. Encouraging interdisciplinary collaboration, emphasizing communication skills, and fostering supportive learning environments may help create more equitable opportunities for students of all genders.

A sense of belonging within academic and professional environments is another key determinant of success in STEM fields. Studies suggest that individuals are more likely to persist when they feel socially and intellectually integrated within their communities. Conversely, environments perceived as exclusionary or highly competitive may reduce engagement and increase attrition, particularly among women (Hill et al., 2010; Margolis & Fisher, 2002). These findings reinforce the importance of inclusive institutional practices that support collaboration, mentorship, and diversity.

The study offers several key contributions. First, it provides a conceptual framework for understanding genderization within STEM disciplines at the level of organizational processes. Second, it extends existing research by shifting the focus from participation and representation to the internal dynamics of disciplinary practices. Third, it highlights the importance of reinterpreting STEM environments as hybrid systems that integrate both structured and collaborative elements, thereby supporting more inclusive perspectives on STEM education and careers.

Furthermore, public discourse, educational reports, and policy-oriented studies continue to highlight the importance of addressing stereotypes and increasing visibility of women in STEM through institutional and societal interventions (Hill et al., 2010; AAUW, 2014).

This study advances the theoretical understanding of STEM disciplines by conceptualizing genderization as a dynamic, process-oriented construct embedded within organizational and disciplinary practices, rather than as a fixed attribute of fields or individuals.

CONCLUSION

This study examines the concept of genderization within STEM disciplines and proposes a framework to understand how disciplinary processes may be characterized as masculine, feminine, or neutral. By analyzing the organizational structures and operational practices within Physics and Software Engineering, the research demonstrated that many stages of STEM activities exhibit collaborative and flexible characteristics commonly associated with feminine organizational traits.

By introducing a process-based framework for analyzing genderization within STEM disciplines, this study contributes to the literature by reframing gender not as an inherent characteristic of fields, but as an emergent property of organizational structures, practices, and interactions.

These findings challenge the conventional perception that STEM disciplines are inherently masculine fields. Instead, they suggest that gendered perceptions of disciplines are socially constructed and shaped by cultural narratives, educational practices, and institutional structures. Recognizing and addressing these perceptions is important for promoting greater diversity and inclusion in STEM education and professions. Encouraging female participation requires not only removing structural barriers but also reshaping the way STEM disciplines are represented and understood.

These results support the broader argument that genderization should be understood as a socially constructed and context-dependent phenomenon rather than an inherent property of disciplines, reinforcing perspectives from organizational theory and gender studies literature.

Future research should focus on empirical validation of the genderization framework through surveys, interviews, and cross-cultural studies. Expanding the analysis to additional STEM disciplines and educational environments may provide deeper insights into how gender perceptions influence participation patterns. Ultimately, a more inclusive understanding of STEM can contribute to a balanced and diverse scientific community.

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