

Gender Inequality in STEM Education: Basis for Gender Sensitization Program

Faith Stephanny C. Silor, Mindanao State University-Iligan Institute of Technology,
Philippines
Adelfa C. Silor, Mindanao State University-Iligan Institute of Technology, Philippines

The Barcelona Conference on Education 2023
Official Conference Proceedings

Abstract

This study aimed to examine the factors contributing to gender inequality in STEM education, and the conclusions served as the foundation for policy recommendations. The findings of this study served as the foundation for a policy on integrating gender equality themes into STEM education. Gender disparity in STEM education is striking, claims New UNESCO (2017). Female students' learning experiences are compromised by gender stereotypes and discriminatory, prejudiced attitudes, which also restrict their options for higher education. This is the study's GAP, which the STEM Education policy has to address. This study used a content analysis-based qualitative methodology. Contextual analysis can be done in one of three ways: traditional, guided, or summative. These methods analyzed the data concepts tied to the paradigm's significance. Data analysis employed coding to identify common themes in the data. The study's conclusions showed that women have a role in science. One of the reasons some females are not interested in STEM is culture. As a result, gender sensitization training programs should be integrated into STEM Education to promote gender equality among students.

Keywords: Curriculum Disparity, Stereotyping

iafor

The International Academic Forum
www.iafor.org

Introduction

Persistent gender inequality in higher education's STEM programs is glaring, spanning fields like engineering, technology, mathematics, biology, and chemistry (Luttenberger, Paechter, & Ert, 2019). The concern deepens as women remain significantly underrepresented, with STEM courses consistently attracting fewer female students (Lazarides & Lauermaun, 2019). The curriculum and instruction in STEM subjects contribute to this gap through stereotyping, further hindering female enrollment (Watt, Shapka, Morris, Durik, Keating, & Eccles, 2012; Watt, 2016). A critical aspect of this gender disparity is the elevated academic requirements, creating formidable obstacles for female students (Ihsen, 2009). This sets the stage for gender discrimination in the selection process for STEM enrollment, as indicated by Causes of Gender Discrimination in STEM (2019). The study underscores that women and men often navigate the world with distinct perspectives, influencing their inclination toward STEM careers. The glaring gap in gender representation within STEM education demands urgent attention. Addressing stereotypes, academic barriers, and discriminatory enrollment practices is pivotal for fostering an inclusive and diverse STEM learning environment. The study recognizes the gravity of these issues and underscores the pressing need for targeted interventions to bridge the gender gap in STEM education.

To overcome these challenges, we need policies that include gender sensitivity in every aspect of STEM education, such as curriculum, instruction, research, community involvement, and school practices (Causes of Gender Discrimination in STEM, 2019). This requires collaborative efforts from administrators, faculty, and diverse stakeholders, embracing different cultures and beliefs. By adopting a multidisciplinary and humanitarian approach, we can create a more fair and inclusive future in STEM. Changing girls' perceptions about STEM is crucial. Many think they aren't naturally skilled and attribute their grades solely to hard work. On the flip side, some boys overly confident in their superiority perpetuate harmful stereotypes (Kessels, 2015). To tackle this, an information campaign for young learners, future STEM students, is vital. They need to understand that STEM is for everyone, regardless of gender, fostering genuine interest and passion (Ertl, Luttenberger, & Paechter, 2017).

Societal perceptions play a role too. Studies show math and science are wrongly seen as exclusively for males (Makarova, Aeschlimann, & Herzog, 2019). This misconception discourages young women from STEM and reinforces the belief in young men that STEM is solely theirs (Makarova, Aeschlimann, & Herzog, 2019). Challenging these biases early on and creating an environment that celebrates diversity and equal opportunities is crucial for a more equitable future in STEM education.

Additionally, women face challenges in job hiring, which affects their choice of STEM courses (Gender Disparities in STEM: What You Need To Know, 2019). Even with excellent performance in STEM education, women are often overlooked, showing gender-based stereotypes in hiring. This disparity is prominent in STEM fields like physical sciences, computer science, math, and engineering (Gender Disparities in STEM: What You Need To Know, 2019). Furthermore, students' personalities and perceptions influence their choice of STEM courses during enrollment (Ihsen, Höhle, & Baldin, 2013; Ertl, Luttenberger, & Paechter, 2014). Women's enrollment in STEM is affected by personal attitudes and characteristics. Unfortunately, male STEM students show higher motivation, leading to fewer women pursuing math and feeling excluded (Else-Quest, Hyde, & Linn, 2010). These practices uphold stereotypes and discrimination against women in STEM, hindering gender

equality. Efforts are crucial to combat biases and create a supportive environment, encouraging all students, regardless of gender, to pursue their interests and talents in STEM.

Literature Review

Promoting gender equality in STEM Education needs active involvement from educational agencies and stakeholders. As the first teachers, parents can influence their children's mindsets, sparking an early interest in STEM Education and preparing them for higher education. Essential education agencies are crucial in making STEM Education inclusive for both boys and girls. Creating a supportive and inclusive learning environment challenges stereotypes and discrimination. Changing these mindsets is a gradual process unfolding over developmental stages (Watt, Eccles, & Durik, 2006; Lent & Brown, 2019; Turner, Joeng, Sims, Dade, & Reid, 2019). Encouraging young learners to love STEM Education requires efforts from parents, educators, and society. By working together to offer equal opportunities and support for all students, regardless of gender, we can pave the way for a more fair and diverse future in STEM.

Cultural beliefs held by parents contribute significantly to stereotyping and discrimination in STEM Education choices. These trainings should also highlight the benefits of pursuing STEM Education for young men and women. By emphasizing equal opportunities and potential success in STEM fields, young learners can be motivated without gender bias (Eccles & Wang, 2016). Both home and school environments are crucial in changing stereotyping concepts about STEM Education. Parents can instill gender equality values at home, while teachers reinforce these principles and support young learners in pursuing STEM fields.

Meaningful change requires addressing and challenging negative concepts within schools and among stakeholders. A more inclusive approach and promoting gender equality in STEM Education will empower young women to enroll and thrive (Eccles & Wang, 2016). Working together to create a welcoming atmosphere can increase the number of young women in STEM and contribute to a diverse and equitable future in these fields. Addressing this concern necessitates providing gender sensitivity training for parents. Teachers can lead these sessions to educate parents, challenge cultural beliefs, and reshape perceptions. This approach seeks to eliminate stereotyping concepts, promoting a more inclusive learning environment (Eccles & Wang, 2016).

Parents hold considerable sway over their daughters' career decisions, including choices related to STEM Education (Ertl, 2010). Therefore, schools must promote gender equality, especially in STEM subjects. Incorporating gender-sensitive practices can inspire young women to pursue STEM careers, helping them overcome discrimination, self-concept issues, and stereotypical beliefs (Ertl, Luttenberger & Paechter, 2017).

Teaching methods should embrace experiential learning and role modeling, showcasing the success stories of STEM graduates (Ertl, Luttenberger & Paechter, 2017). Establishing a gender-sensitive classroom aligned with STEM Education sets the stage for a brighter future for all students (Ertl, ed., 2010). Research suggests that the school environment has a more significant impact on influencing career choices than the home environment (Dresel, Schober, & Ziegler, 2007).

Schools and homes may have different cultural beliefs, but by forming a partnership with a shared vision to change young learners' mindsets regarding gender equality in STEM Education, both parents and teachers can play crucial roles in this transformative process (Dresel, Schober, & Ziegler, 2007). Collaborative efforts can create a supportive and inclusive atmosphere, empowering young women to pursue their interests in STEM fields and contributing to a more diverse and equitable future.

Moreover, for gender equality in STEM Education, it's crucial to boost the enrollment of young men and women in various industries and agencies. To achieve hiring processes, we must actively prioritize diversity and inclusivity, ensuring STEM careers offer equal employment opportunities (Paechter, Luttenberger, & Ertl, 2020). By taking these steps, we can progress toward eradicating gender inequality in the STEM Education profession (Paechter, Luttenberger, & Ertl, 2020).

It is vital to recognize that girls often start feeling uneasy about STEM subjects in their early education, recognizing that girls usually begin feeling anxious about STEM subjects in their early education (Paechter, Luttenberger, & Ertl, 2020). School Practices, especially during primary basic education, may contribute to this unease through stereotyping. Some teachers might unintentionally emphasize boys' better performance in STEM, suggesting that girls lag. This perception can make girls hesitant to engage with STEM subjects. To address this, teachers play a crucial role in creating a positive learning environment. Educators can inspire girls to love STEM subjects through effective and inclusive teaching methods. Educators can encourage girls to love STEM subjects through effective and inclusive teaching method through effective and inclusive teaching methods, educators can inspire girls to love STEM subjects, boosting their confidence and interest (Paechter, Luttenberger, & Ertl, 2020). Encouraging girls to embrace STEM subjects from a young age can dismantle barriers and empower them to pursue STEM Education with enthusiasm and determination.

Teachers are crucial in guiding young women toward choosing STEM for their higher education. Acting as supportive guidance counselors, they should specifically encourage girls to consider STEM Education as a rewarding and fulfilling career choice. Nurturing the intellectual potential of young girls is essential for fostering a positive outlook on learning STEM subjects to the fullest (Paechter, Luttenberger, & Ertl, 2020).

Particular attention is needed in math subjects, where girls are often unfairly perceived as inferior to boys. Despite their ability to excel in math, stereotyping concepts can undermine their confidence and motivation to learn (Lazarides & Lauer mann, 2019). This may lead to lower grades in math, limiting opportunities for higher education in STEM curricula (Lazarides & Lauer mann, 2019). These barriers hinder them from pursuing their interests and passions in STEM Education (Lazarides & Lauer mann, 2019).

To overcome these challenges, teachers must actively work to dismantle stereotypes and biases contributing to gender disparities in math and other STEM subjects. Teachers can help young women develop confidence and break free from societal expectations by providing a supportive and empowering learning environment. Teachers can help young women build confidence and break free from societal expectations by providing a supportive and empowering learning environment. Teachers can help young women develop confidence and break free from societal expectations by providing a supportive and empowering learning environment. Teachers can help young women build confidence and break free from societal expectations by providing a supportive and empowering learning environment. Teachers can

help young women develop confidence and break free from societal expectations. Encouraging girls to embrace STEM subjects based on their capabilities and interests can pave the way for greater gender equality and diversity in STEM fields.

Another aspect of stereotyping involves the belief that boys are better at math while girls excel in language areas. It's essential to challenge and change these ideas. Gender equality should be in all areas, including academic performance. Teachers play a significant role in shaping the minds of both boys and girls, promoting the idea that math and language abilities are equal for everyone (Lazarides & Lauer mann, 2019).

Starting in early education, teachers should share information and explain that math is for everyone, regardless of nation, and that math is for everyone, regardless of gender. They should highlight across the curriculum that learning math can be enjoyable and fun, dispelling fears or apprehensions. Inclusive activities should show gender equality in future careers, especially emphasizing the benefits and usefulness of STEM Education worldwide. It is crucial to implement gender equality in enrollment processes. Cultivating an inclusive environment in STEM Education can generate enduring work opportunities for women, contributing to the battle against poverty. When preparing career plans for young learners, teaching math and promoting it as a favorite domain for girls should be a vital part of the process (Lazarides & Lauer mann, 2019). By breaking down gender stereotypes and empowering all students to pursue their interests without bias, we can shape a more fair and diverse future for STEM Education and beyond.

Gender Equality Is Essential in STEM Education

Gender inequality remains in science, technology, engineering, and mathematics (STEM) education despite various strategies. Girls encounter obstacles that limit their access to opportunities and preferred courses (New UNESCO report on gender inequality in STEM education, 2017). Consequently, their income stability is affected by gender inequality impacting their careers (New UNESCO report on gender inequality in STEM education, 2017).

The Status of Girls in STEM Education

Young women face substantial obstacles in enrolling in STEM Education due to gender inequality. Stereotypes and biased approaches toward students have played a role in creating this disparity. For example, during enrollment, priority is often given to young men, limiting opportunities for young women. Even those excelling in STEM subjects encounter gender disparity in choosing STEM careers due to biases and stereotypes (New UNESCO report on gender inequality in STEM education, 2017).

To tackle this issue, it's crucial to recommend policies that change the enrollment process in STEM Education. We need inclusive policies to encourage and support young women's enrollment in STEM and provide equal job opportunities in industries and educational agencies. By implementing these policies into action, we can strive for a fairer and more diverse future in STEM, empowering young women to pursue their interests and talents in these fields.

The Obstacles or Challenges

The enrollment of girls in STEM Education is a concern shared by many countries. Girls often have limited educational pathways, especially in the classroom, leading to gender disparity in STEM subjects (New UNESCO report on gender inequality in STEM education, 2017). This results in more male students receiving quality education while women remain underrepresented in STEM fields. It's crucial to address this issue to achieve gender equality in STEM subjects, offering both men and women equal opportunities for personal and professional growth.

The existing gender disparity has caused a loss of interest among girls to lose interest in STEM subjects. This disparity is noticeable from early to secondary education, where gender gaps persist in math and science (New UNESCO report on gender inequality in STEM education, 2017). As a result, many women abandon their pursuit of STEM subjects at higher education levels. This leads to fewer opportunities for women when applying for sustainable jobs, as many industries prioritize expertise and experience in STEM Education careers (New UNESCO Report on gender inequality in STEM Education, 2017).

To create a more equitable future, it's crucial to implement policies and practices fostering gender equality in STEM Education. By providing equal opportunities and support for girls in their STEM studies, we can empower them to pursue fulfilling careers and contribute to diverse and thriving STEM industries.

Negative Stereotypes Associated With Girls

Negative stereotypes about girls develop through the human development process, starting from birth and evolving through social interactions as a child grows. For example, suppose a mother tells her daughter that math is difficult and meant only for boys who excel in it. In that case if a mother tells her daughter that math is difficult and meant only for boys who excel in it, negative thoughts can take root in the child's mind (New UNESCO report on gender inequality in STEM education, 2017). Cultural beliefs and family norms also play a significant role in shaping a child's negative stereotypes.

Family practices and influences continue to contribute to a child's mindset throughout the human development stages. When a child starts school, teachers influential in shaping their concepts and beliefs. Interactions with friends and the broader community further influence young learners' attitudes, even affecting family dynamics at home (New UNESCO report on gender inequality in STEM education, 2017). Home, school, and community learning environments The learning environments of home, school, and community collectively contribute to young learners' negative stereotype thoughts, impacting their career choices (New UNESCO report on gender inequality in STEM education, 2017).

Unfortunately, suppose parents, family members, and teachers and family members, as well as teachers, continually emphasize that STEM subjects are only for males. In that case, if parents, family members, and teachers and family members, as well as teachers, continually emphasize that STEM subjects are only for males, girls may develop apprehensions and fear towards math, feeling inferior to boys in STEM subjects (New UNESCO report on gender inequality in STEM education, 2017). Addressing these negative stereotypes and biases is crucial to creating an inclusive and supportive environment that encourages girls to explore and excel in STEM fields without limitations or biases.

Societal Constructs That Define Gender Roles and Norms

Educational agencies have a crucial role in boosting girls' self-confidence, courage, and interest in becoming passionate learners of STEM subjects. Schools, in particular, bear significant responsibility in incorporating empowerment concepts for girls in STEM into their curriculum. This helps in creating an environment that not only encourages but also supports girls in pursuing STEM Education. This includes promoting gender equality in job opportunities and highlighting the benefits of STEM careers. To achieve this, educational agencies must adopt policies ensuring equal access for girls and women to STEM careers, facilitating their journey to decent work opportunities through STEM fields. Gender equality in STEM subjects should be integrated throughout the entire educational journey, starting from early childhood education and continuing through higher education. Collaboration between schools and stakeholders is vital to creating and implementing policies promoting gender equality in STEM Education (New UNESCO Report on gender inequality in STEM Education,2017).

Fields Related to Science, Technology, Engineering, and Mathematics (STEM)

The sustainability of STEM subjects can significantly contribute to a country's international competitiveness. STEM Education curriculum equips learners to be critical thinkers, collaborators, and problem solvers (Reinking, & Martin,2018). However, gender inequalities persist in students' career choices in STEM, both in higher education and the workplace ((Reinking, & Martin,2018. The hiring of faculty in higher education also exhibits gender disparities, with women having fewer opportunities to teach in computer science, mathematics, engineering, and physical sciences (Girls, Inc., 2016).

Professionals in STEM Education also experience gender gaps in motivational strategies. For instance, males are more likely to receive extrinsic motivation in STEM-related subjects, while females receive it in other areas (Burton, 986). These disparities are influenced by external factors, such as parents, teachers, and societal expectations, which contribute to gendered socialization (Leaper, 2014). Generations of women have not been encouraged to pursue STEM interests, perpetuating this pattern (Reinking, & Martin, 2018). To create a more equitable future, it is essential to address these gender biases and encourage all individuals to explore their interests and passions in STEM subjects. By promoting diversity and inclusivity in STEM Education, we can foster a thriving and innovative environment that benefits society as a whole.

Achieving a Balance Between Genders

Gender differences in STEM, particularly in mathematics, have been observed as early as in early childhood education (Knowledge into action research briefing: LOOKING AT GENDER BALANCE IN STEM SUBJECTS AT SCHOOL,2015). This highlights the significance of instilling an interest in STEM subjects from a very young age, considering the impact of social learning experiences (Knowledge into Action research briefing: LOOKING AT GENDER BALANCE IN STEM SUBJECTS AT SCHOOL,2015). Unfortunately, girls in early childhood education tend to perceive science and technology subjects as not suitable for them [28]. Therefore, it is crucial to recognize and promote gender equality in STEM during the early years of children to positively influence young girls' engagement in sciences (Knowledge into action research briefing: LOOKING AT GENDER BALANCE IN STEM SUBJECTS AT SCHOOL, 2015).

Families, teachers, and workers are challenged to introduce innovative approaches that encourage women to develop a passion for STEM careers even during their childhood education (Knowledge into Action research briefing: LOOKING AT GENDER BALANCE IN STEM SUBJECTS AT SCHOOL,2015). Despite equal or even better performance in science and STEM subjects, girls often lack self-efficacy or confidence in their abilities (Knowledge into Action research briefing: LOOKING AT GENDER BALANCE IN STEM SUBJECTS AT SCHOOL,2015). Addressing this issue early on can help build girls' self-confidence and enthusiasm in STEM fields, leading to a more balanced and diverse representation in these areas.

The Perspective From a Cultural Standpoint

To understand gender inequality in STEM Education (Miner, Walker, Bergman, Jean, Carter-Sowell, January, & Kaunas, 2018), a variety of perspectives are required. Analyzing gender disparities in STEM is challenging, as they are intertwined with societal structures, procedures, and concepts related to gender (Katsuhiko Yoshikawa Akiko Kokubo and Chia-Huei Wu, 2018). Academic researchers across science and technology fields have observed that women's representation diminishes significantly in the higher echelons of organizational hierarchies, with slower career progression compared to men (EPMEWSE,2016). This disparity becomes more pronounced as women move into their 50s, resulting in lower salaries and limited opportunities in both industry and academic institutions (EPMEWSE,2016).

The attitudes of elders also impact students in STEM Education (Muramatsu, Kawano, Nakazawa, Fujiwara, & Takahashi, 2004). Female students who have completed their STEM education often encounter difficulties in continuing their STEM careers due to household chores and other domestic responsibilities. Culturally, women are often perceived as caregivers for their families (Katsuhiko Yoshikawa Akiko Kokubo and Chia-Huei Wu, 2018).

To address gender inequality in STEM, a comprehensive approach is necessary, taking into account the multifaceted factors contributing to the issue. By promoting equal opportunities, challenging cultural norms, and supporting work-life balance, we can create an environment that fosters diversity and inclusivity in STEM fields, empowering women to pursue and thrive in their STEM careers.

The Perspective From a Feminist Standpoint

The issue of STEM education and careers for girls and women is a global problem, with substantial disparities observed across different regions. Limited access to education due to cultural and ethnic discrimination based on sex, color, and functionality remains a significant challenge (Hussénus,2020). Biases suggesting that men possess a higher innate talent for certain subjects compared to women persist in various disciplines, including physics, mathematics, engineering, computer science, and even philosophy, albeit to varying degrees in each field (Leslie, Cimpian, Meyer, &Edward, 2015).

In the context of STEM education, the way content is taught often conveys an implicit message about who the discipline is intended for and who can access it (Lemke, Jay. 1990). Feminist philosophers have long criticized the cultural expression and power dynamics within natural sciences, highlighting an imbalance of power characterized by masculine

gender coding that persists at both structural and symbolic levels in STEM education (Harding, 1986 & Stengers, 2018). These inequalities are deeply rooted and have historical origins, perpetuating gender disparities within STEM education (Archer, DeWitt, Osborne, Dillon, Beatrice Willis, & Wong. 2012; Scantlebury, 2014).

Various insights suggest that the root causes of gender inequality in STEM Education can be traced back to early childhood education. Home environments, schools, and communities significantly influence children's mindsets at an early stage of their development. Social learning during human development sheds light on the different conditions that exist for participation in STEM education (Hussénus, 2020).

Addressing gender inequality in STEM Education requires a comprehensive approach, involving systemic changes, cultural shifts, and inclusive policies to provide equal opportunities and support for girls and women pursuing STEM careers. By challenging biases and fostering an environment that empowers all individuals to pursue their interests in STEM, we can work towards achieving greater gender equality in these fields.

Methodology

This study adopts a qualitative approach utilizing content analysis, employing three different methods: conventional, directed, and summative. These approaches are utilized to analyze data by anchoring the concepts to the paradigmatic meaning. The data analysis process employs common themes through coding (Reinking, & Martin, 2018). The insights gathered from literature reviews, related to the causes of gender inequality in STEM Education, are collected and categorized using thematic analysis.

Findings and Discussions

Based on a thorough review of the literature using qualitative content and thematic analysis, the following findings on the causes of gender inequality in STEM Education have been identified:

1. One of the primary causes of gender inequality in STEM Education originates from early childhood education. The home environment, schools, and communities during a child's early stages significantly influence their mindset. Social learning during human development sheds light on the various conditions that exist for participation in STEM education.
2. Attitudes of elders have an impact on students in STEM Education. Female students who have completed education in STEM fields encounter challenges in continuing their STEM careers due to household chores and other home responsibilities. Culturally, women are often perceived as caregivers for their families.
3. Gender differences in STEM, particularly in mathematics, have been observed during early childhood education. This implies that cultivating an interest in STEM among early learners should commence at a very young age, given the influence of social learning experiences. Girls in childhood education tend to perceive science and technology subjects as not suitable for them.

4. The upbringing of children affects the perceptions of girls and women that STEM subjects are predominantly for males. Consequently, female students may feel inferior to males in the performance of STEM Education.

5. Families, teachers, and workers face the challenge of devising innovative ways to encourage women to develop a passion for STEM careers as early as during childhood education. Despite equal or even superior performance to boys, girls often lack self-efficacy or confidence in their own abilities in science and STEM subjects.

6. Educational agencies hold the potential to effect change and assist girls in enhancing their self-confidence, courage, and interest in becoming passionate learners of STEM subjects. Schools have a significant responsibility to incorporate empowerment concepts for girls in STEM into their curriculum, as well as empowering them with job opportunities and benefits of STEM Education.

Policy Recommendations to Close the Gender Gap in STEM Education

The policy recommendation is a solution to solve the gender gap in STEM Education. This policy is about the integration of gender equality in STEM subjects in early childhood education. Another policy recommendation is for the parents' information drive on the proper upbringing of their children on gender equality in STEM subjects. There would also be policy for teachers to integrate the concepts of gender equality of STEM Education in the curriculum and instruction.

Conclusion

Based on the content and thematic analysis of literature reviews related to the causes of gender inequality in STEM Education, it has been determined that the primary cause of this inequality stems from early childhood education. The home environment, including parental upbringing and family interactions, particularly in cultural beliefs and norms, significantly influence children's mindsets. Parents often perceive STEM subjects as exclusively for males, while females are encouraged to pursue other related subjects, such as language areas. Teachers play a pivotal role as partners with parents in promoting gender equality in STEM Education. Integrating gender equality in STEM with other related subject areas becomes a strategic approach to teaching students.

Addressing gender stereotyping and biases in STEM Education is crucial from early childhood through adolescence. Implementing a Gender Sensitization Program during this period can help increase the enrollment of young women in STEM Education. By instilling a sense of gender equality and challenging stereotypes at an early age, we can pave the way for more girls to pursue and thrive in STEM fields.

References

- Anita Hussénus. (2020). Trouble the gap: gendered inequities in STEM education. *Gender and Education* Volume 32, 2020 - Issue 5: Trouble the Gap: Gendered Inequities in STEM Education.
- Archer, Louise, Jennifer DeWitt, Jonathan Osborne, Justin Dillon, Beatrice Willis, and Billy Wong. (2012). "Science Aspirations, Capital, and Family Habitus: How Families Shape Children's Engagement and Identification with Science." *American Educational Research Journal* 49 (5): 881–908. doi:10.3102/0002831211433290 [Crossref], [Web of Science ®], [Google Scholar]
- Burton, M. D. (1986). Gender differences in professional socialization: A study of women and men in the computer science (Doctoral dissertation). Retrieved from: <http://repository.cmu.edu/cgi/viewcontent.cgi?article=1037&context=hsshonors>
- Causes of Gender Discrimination in STEM.(2019). <https://www.enago.com/academy/gender-disparities-in-stem-what-you-need-to-know/>
- Dresel, M., Schober, B., and Ziegler, A. (2007). Golem und "Pygmalion. Scheitert die Chancengleichheit von Mädchen im mathematisch-naturwissenschaftlich-technischen Bereich am geschlechtsstereotypen Denken der Eltern?," in *Erwartungen in Himmelblau und Rosarot. Effekte, Determinanten und Konsequenzen von Geschlechterdifferenzen in der Schule*, eds P. H. Ludwig and H. Ludwig (Weinheim: Juventa), 61–81.
- Eccles, J. S., and Wang, M. T. (2016). What motivates females and males to pursue careers in mathematics and science? *Int. J. Behav. Dev.* 40, 100–106. doi:10.1177/0165025415616201
- Else-Quest, N. M., Hyde, J. S., and Linn, M. C. (2010). Cross-national patterns of gender differences in mathematics: a meta-analysis. *Psychol. Bull.* 136, 103–127. doi:10.1037/a0018053
- EPMEWSE (Japan Inter-Society Liaison Association Committee for Promoting Equal Participation of Men and Women in Science and Engineering). (2016). Report of 4th Survey of Equal Participation of Man and Women Among Science and Technology Professionals. Retrieved from <http://www.djrenrakukai.org/enquete.html#enq>. Google Scholar
- Ertl, B., Luttenberger, S., & Paechter, M.(2017). The Impact of Gender Stereotypes on the Self-Concept of Female Students in STEM Subjects with an Under-Representation of Females. *Front. Psychol.*, 17 May 2017. <https://doi.org/10.3389/fpsyg.2017.00703>. <https://www.frontiersin.org/articles/10.3389/fpsyg.2017.00703/full>
- Ertl, B., Luttenberger, S., and Paechter, M. (2014). Stereotype als Einflussfaktoren auf die Motivation und die Einschätzung der eigenen Fähigkeiten bei Studentinnen in MINT-Fächern. [Stereotypes as influencing factors on motivation and assessment of one's own skills of female students in STEM-subjects]. *Gruppendynamik und Organisationsberatung* 45, 419–440. doi:10.1007/s11612-014-0261-3

- Ertl, B., Luttenberger, S., & Paechter, M. (2017). The Impact of Gender Stereotypes on the Self-Concept of Female Students in STEM Subjects with an Under-Representation of Females. *Front. Psychol.*, 17 May 2017. <https://doi.org/10.3389/fpsyg.2017.00703>. <https://www.frontiersin.org/articles/10.3389/fpsyg.2017.00703/full>
- Ertl, B. (ed.). (2010). *Good Practice Guidelines - Part II: Facilitation Methods*. München: Projekt PREDIL.
- Gender Disparities in STEM: What You Need To Know (2019). <https://www.enago.com/academy/gender-disparities-in-stem-what-you-need-to-know/>
- Girls, Inc. (2016). *Science, Math, and Relevant Technology*. Retrieved from <http://www.girlsinc.org/resources/programs/girls-inc-operation-smart.html>
- Harding, Sandra. (1986). *The Science Question in Feminism*. Ithaca: Cornell University Press. [Google Scholar]
- Hill, C., Corbett, C., & St. Rose, A. (2010). *Why so few? Women in science, technology, engineering, and mathematics*. AAUW. Retrieved from <https://www.aauw.org/files/2013/02/Why-So-Few-Women-in-Science-Technology-Engineering-and-Mathematics.pdf>
- Ihsen, S. (2009). "Spurensuche. Entscheidungskriterien für Natur- bzw. Ingenieurwissenschaften und mögliche Ursachen für frühe Studienabbrüche von Frauen und Männern an den TU9-Universitäten," in Bundesministerium für Bildung und Forschung, EU, Europäischer Sozialfonds für (Deutschland: TUM)
- Ihsen, S., Höhle, E. A., and Baldin, D. (2013). "Spurensuche!: Entscheidungskriterien für Natur-bzw. Ingenieurwissenschaften und mögliche Ursachen für frühe Studienabbrüche von Frauen und Männern an TU9-Universitäten. [Tracking!: decision criteria for science and engineering and possible causes for early dropouts of women and men at TU9 universities.]" in *TUM gender- und diversity-studies*, vol. 1 (Berlin: LIT).
- Katsuhiko Yoshikawa Akiko Kokubo and Chia-Huei Wu. (2018). *A Cultural Perspective on Gender Inequity in STEM: The Japanese Context*. Published online by Cambridge University Press: 19 June 2018.
- Kessels, U. (2015). Bridging the gap by enhancing the fit: how stereotypes about STEM clash with stereotypes about girls. *Int. J. Gend. Sci. Technol.* 7, 280–296. Knowledge into action research briefing: LOOKING AT GENDER BALANCE IN STEM SUBJECTS AT SCHOOL. September 2015
- Lazarides, R. and Lauermaun, F. (2019). Gendered Paths Into STEM-Related and Language-Related Careers: Girls' and Boys' Motivational Beliefs and Career Plans in Math and Language Arts. *Front. Psychol.*, 06 June 2019. <https://doi.org/10.3389/fpsyg.2019.01243>

- Leeper, C. (2014). Parents' socialization of gender in children. *Encyclopedia on Early Childhood Development*. Retrieved from <http://www.child-encyclopedia.com/gender-early-socialization/according-experts/parents-socialization-gender-children>
- Lemke, Jay. (1990). *Talking Science: Language, Learning, and Values*. Norwood, NJ: Ablex Publishing Corporation. [Google Scholar]
- Lent, R. W., and Brown, S. D. (2019). Social Cognitive Career Theory at 25: empirical status, choice, and performance models. *J. Vocat. Behav.* 115:103316. doi:10.1016/j.jvb.2019.06.004
- Leslie, Sarah-Jane, Andrei Cimpian, Meredith Meyer, and Edward Freeland. (2015). "Expectations of Brilliance Underlie Gender Distributions Across Academic Disciplines." *Science* 347 (6219): 262–265. doi:10.1126/science.1261375 [Crossref], [PubMed], [Web of Science ®].
- Luttenberger, S. Paechter, M. & Ert, B. (2019). Self-Concept and Support Experienced in School as Key Variables for the Motivation of Women Enrolled in STEM Subjects With a Low and Moderate Proportion of Females. *Front. Psychol.*, 26 June 2019. <https://doi.org/10.3389/fpsyg.2019.01242>
- Makarova, E., Aeschlimann, B. Herzog, W. (2019). The Gender Gap in STEM Fields: The Impact of the Gender Stereotype of Math and Science on Secondary Students' Career Aspirations. *Front. Educ.*, 10 July 2019. <https://doi.org/10.3389/feduc.2019.00060>
- Miner, K. N., Walker, J. M., Bergman, M. E., Jean, V. A., Carter-Sowell, A., January, S. C., & Kaunas, C. (2018). From "her" problem to "our" problem: Using an individual lens versus a social-structural lens to understand gender inequity in STEM. *Industrial and Organizational Psychology: Perspectives on Science and Practice*, 11 (2), 267–290. CrossRef Google Scholar.
- Muramatsu, Y., Kawano, G., Nakazawa, T., Fujiwara, C., & Takahashi, M. (2004). Gender differences in science learning of Japanese junior high school students: A two-year study. Paper presented at the Annual Meeting of the American Educational Research Association, San Diego, CA. Retrieved from <https://files.eric.ed.gov/fulltext/ED452068.pdf>
- New UNESCO report sheds light on gender inequality in STEM education 8/29/2017. Available at <https://en.unesco.org/news/new-unesco-report-sheds-light-gender-inequality-stem-education>
- Paechter, M., Luttenberger, S., Ertl, B. (2020). Distributing Feedback Wisely to Empower Girls in STEM. *Front. Educ.*, 19 August 2020. <https://doi.org/10.3389/feduc.2020.00141>
- Reinking, A. and Martin, B. (2018). The Gender Gap in STEM Fields: Theories, Movements, and Ideas to Engage Girls in STEM. *JOURNAL OF NEW APPROACHES IN EDUCATIONAL RESEARCH* Vol. 7. No. 2. July 2018. pp. 148–153 ISSN: 2254-7339 DOI:10.7821/naer.2018.7.271

- Stengers, Isabelle. (2018). *Another Science Is Possible. A Manifesto for Slow Science*. Cambridge: Polity Press. [Google Scholar].
- S. N., and Reid, M. F. (2019). SES, gender, and STEM career interests, goals, and actions: a test of SCCT. *J. Career Assess.* 27, 134–150. doi:10.1177/1069072717748665
- Watt, H. M. G., Shapka, J. D., Morris, Z. A., Durik, A. M., Keating, D. P., and Eccles, J. S. (2012). Gendered motivational processes affecting high school mathematics participation, educational aspirations, and career plans: a comparison of samples from Australia, Canada, and the United States. *Dev. Psychol.* 48, 1594–1611. doi:10.1037/a0027838
- Watt, H. M. G. (2016). “Gender and motivation,” in *Handbook of Motivation at School*, eds K. Wentzel and D. Miele (New York, NY: Routledge), 320–339.
- Watt, H. M. G., Eccles, J. S., and Durik, A. M. (2006). The leaky mathematics pipeline for girls: a motivational analysis of high school enrolments in Australia and the USA. *Equal Opportun. Int.* 25, 642–659. doi:10.1108/02610150610719119

Contact email: cyberwesky@gmail.com