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Guest Editorial - Future Directions in Theory, Research, Policy and Practice

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ABSTRACT

Guest editors Dr Emma Burns and Dr Hye Rin Lee provide a synthesis of the articles comprising this special issue that highlights paths forward in gender and STEM research.

KEYWORDS: Network Gender & STEM; journal special issue; guest editorial

INTRODUCTION

Despite concerted efforts over the years, gendered trends and disparities in STEM engagement, education, and employment continue to be ongoing issues across most countries (OECD, 2025). Despite this broader trend, ongoing research in this space has provided needed insights that nuance our understandings of gender and STEM. For example, research has highlighted the importance of exploring the role of gender across science subfields and how patterns of engagement and enrolment may vary across these fields (e.g., Toh & Watt, 2022). Similarly, research has indicated the importance of disentangling different stereotypes in STEM, both about gender, why individuals pursue STEM, and who scientists are (e.g., Dicke et al., 2019; Diekman & Steinberg, 2013; Starr & Leaper, 2024; Steinke, 2017). All of this research contributes to developing a richer understanding of the varied psychological, social, and structural factors that contribute to gendered trends in STEM.

The articles in this special issue of IJGT contribute to these ongoing efforts to nuance understanding of how gender impacts STEM engagement but also what can be done to best support students and those working in STEM fields. The articles included in this special issue were part of the 7th Network Gender & STEM Conference, hosted in 2024 in Heidelberg, Germany, and the theme of which was, "Future Directions in Theory, Research, Policy and Practice." The articles included in this special issue are diverse in their sampling, theoretical frameworks, and methodologies. This diversity is crucial to tackle the sticky problem of gender and STEM and broader questions of advancing gender equity in education. In the spirit of the theme, below we offer a synthesis of the future directions that are highlighted by the papers below and how researchers may continue to build and expand on this work.

Paths Illuminated by the Research in this Special Issue

Richness of Interview and Focus Groups. A variety of methodological and analytic approaches is needed to understand the iterative ways in which gender informs STEM participation, engagement, and enrolment. The themes featured in this special issue highlight that interviews and focus groups can offer insight into how individuals make sense of their current and past experiences that shape how they understand themselves in relation to STEM.

Musters et al. used focus groups of secondary school students and teachers with an explicit focus on physics. This study shows the value of triangulating teachers and student perspectives to understand how each group understands the role of gender in physics and the different implicit assumptions that both bring to discussions of how physics education can be improved. This study also demonstrates the value of using stimulating artefacts to support richer discussion and to encourage participants to move beyond initial socially desirable conversations of gender equity to the differences in behaviours and practices they observe in the classroom.

Dorrance Hall et al. consider the role of parental support in undergraduate women's persistence and interest with STEM. In particular, they were interested in how women made sense of previous and current experiences of parent support, whether this support had the intended positive outcomes or were interpreted in unexpected ways. Using semi-structured interviews, the authors identified multiple forms of

parental support (i.e., informational, tangible, emotional, esteem, network) that women understood to have informed their engagement and persistence in STEM. This approach highlights the value of reflection on informative experiences and how this can illuminate pathways to intervention.

Ransiek & Mischau focus on doctoral candidates, postdoctoral researchers, and senior academic leaders (who often act as gatekeepers). Their interviews with these groups focused on what individuals perceived as the enabling and constraining factors that may prevent academic and career advancement of highly accomplished individuals in mathematics. As with Musters et al., this study demonstrates that core tensions in perspectives can be illuminated by contrasting the perspectives of those in their early career stage with those who are in leadership positions. These tensions help to understand how gendered barriers may be perceived differently, as well as who is perceived as responsible for navigating and eliminating such barriers.

These studies demonstrate that how women make sense of their journey in STEM, at whichever stage of development (high school, undergrad, postgraduate) is a valuable tool for understanding how the gendered barriers and challenges in STEM evolve overtime. Understanding this evolution is key to developing lifespan-oriented theories of gender in STEM, but also to provide practical guidance to women and other educational stakeholders about how to navigate the challenges they may face.

Need for Role Models at all Stages of Career Development. The STEM leaky pipeline operates across the educational and career lifespan. As such, it is important to understand the factors that operate at different levels of career development and the salience of different factors across time. Of particular interest is the role of role models and mentors at all stages of development and how these social agents can act as potential futures for women in STEM.

Sadler et al.'s case study of the "Who wants to be a Superhero" program highlights the importance of diverse role models in children's television programming to help them see the diversity of pathways within STEM. The authors demonstrated that primary school aged girls' exposure to women working in STEM and the array of possible careers helped increase the number of girls who did not see STEM as a career path to a maybe or a yes (increase from initial 16% yes to final 44% yes). This suggests that role models can be powerful tools to not foreclosing STEM futures for primary school students.

Earle & Jones focused on the need for role models and coaching in academia, with a specific focus on underrepresented early career academics in engineering. The authors tested a novel coaching approach by pairing early career academics with senior academic coaches that supported their career ambitions. The results indicated that one-to-one coaching helped the early career academics feel more motivated, competent, and connected in the careers. It also helped individuals feel more capable in navigating the 'hidden curriculum' of academia.

Together these studies demonstrate that role models and coaches may play a vital role in keeping STEM pathways open, but in different ways. In early years, role models may help students to see a future for themselves that they have not previously considered or may have felt was out of reach for them. In later years,

role models and coaches may be critical to helping women thrive in their chosen STEM career. This provides important understanding for how to tailor role model and coaching programs to different age groups.

Strengthening Theory. Critical to advancing current understanding and scholarship in questions of gender and STEM is drawing on robust theory. Additionally, innovation occurs where robust theories are brought into conversation with one another to nuance understanding and develop new lines of inquiry. The articles in this special issue showcase that effective research and interventions programs are theoretically driven.

Zander et al. examine the role of cooperative and help seeking behaviours in STEM. The authors draw on the rich field of self-regulation and self-regulated learning to understand how cooperative mindsets and help seeking behaviours relate to one another. The authors found that cooperative mindsets were strongly positively associated with adaptive help-seeking behaviour in STEM and in turn, higher STEM engagement.

Folkerts & Bräuer's case study is of the Niedersachsen-Technikum, which is a preparatory study program (founded in 2010) for girls who are interested but undecided about whether to continue with STEM. The girls participate in an internship and receive career mentoring and advice. The program is rigorously informed by social cognitive career theory. The success of the program, signified by the fact that >80% of participants continued on to studying STEM at university, highlights the importance of developing theory driven interventions and programs.

Förtsch examines the career ambitions of women in computer science and how adherence to gender roles may influence their decisions. To understand this, the authors mainly draw on Abele's model of gender and career expectations but also consider theoretical insights from situated value theory and social cognitive career theory. In doing so, the authors are able to better understand how strength and value of beliefs relating to gender roles as well as career goals may inform the decisions that women in computer science make about their future.

These three studies highlight the importance of strong theory in STEM research. Given the broad array of factors that can impact girls' and women's decisions to stay in STEM, it is important to utilize robust theoretical frameworks that provide rationales for the mechanisms that may be at play and why.

Considering the Micro to Macro. Understanding the gendered ways in which individuals engage (or not) with STEM cannot be explained by only one level of analysis. Instead, it is important that research spanning ecological levels of study– micro to macro– are speaking to one another. Finding points of convergence across these studies can bring new insights.

Ruthsatz & Quaiser-Pohl examined individuals' mental rotation ability, which has been historically linked with STEM performance. Their work advances the use of gender-neutral stimuli and understanding of whether stimuli are confounding factors in previous gender differences reported in mental rotation. They found that although women still reported higher anxiety related to mental rotation, no gender differences were seen in performance on the mental rotation tasks. Although

focused on the microlevel (i.e., cognition) the findings speak to higher ecological levels relating to experimental design.

Keil et al. focused on the role of media and how the value of science is communicated to girls. The authors articulate the importance of understanding how media shapes discourse and understanding of who belongs in STEM, and particularly engineering and technology. Using a multimethod approach, the research team worked with adolescent girls to better understand how they would like technology topics communicated to them and how such topics can be made more relevant. Results indicated that elevating student voice can inform how media can be used to enhance girls engagement in STEM if practices beyond those typically used in male dominated spaces are adopted.

These studies focused on different ecological levels, each of which provides avenues of further research. They highlight the importance of considering the very varied inputs (stimuli, media, culture) that may inform how girls think about themselves in STEM and how these may impede or empower them to continue with STEM.

CONCLUSION

All in all, the papers in this special issue demonstrate the myriad ways gender shapes STEM experiences and pathways across the lifespan, drawing on both quantitative and qualitative approaches. Together, these studies highlight four central themes that integrate the diverse contributions: (1) the richness of interviews and focus groups for illuminating lived experiences, (2) the need for role models at all stages of career development, (3) the importance of strengthening theory to guide research and intervention, and (4) the value of considering micro- to macro-level influences on STEM engagement. As research increasingly shows, understanding individuals' experiences in STEM requires triangulating perspectives, social contexts, and ecological levels. The studies presented here offer important models for how such integration can be achieved. Looking ahead, we encourage researchers to continue building and refining theories that capture the complexity of gendered experiences in STEM and to prioritize work that meaningfully connects research to practice and policy. By doing so, the field can more effectively support gender-diverse individuals in pursuing, persisting, and thriving in STEM.

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REFERENCES

Dicke, A.-L., Safavian, N., & Eccles, J. S. (2019). Traditional gender role beliefs and career attainment in STEM: A gendered story? *Frontiers in Psychology, 10*(1053), 1–14. https:// doi. org/ 10. 3389/ fpsyg.2019. 010530

Diekman, A. B., & Steinberg, M. (2013). Navigating social roles in pursuit of important goals: A communal goal congruity account of STEM pursuits. *Social and Personality Psychology Compass*, *7*(7), 487-501. https://doi.org/10.1111/spc3.12042

OECD (2025), *Gender Differences in Education, Skills and STEM Careers in Latin America and the Caribbean: Insights from PISA and PIAAC*, OECD Publishing, Paris, https://doi.org/10.1787/4ea07281-en.

Starr, C. R., & Leaper, C. (2024). That's not me:(Dis) concordance between pSTEM nerd-genius stereotypes and self-concepts predicts high school students' pSTEM identity. *Social Psychology of Education*, *27*(3), 1161-1192. https://doi.org/10.1007/s11218-023-09851-6

Steinke, J. (2017). Adolescent girls' STEM identity formation and media images of STEM professionals: Considering the influence of contextual cues. *Frontiers in psychology*, *8*, 239856. https://doi.org/10.3389/fpsyg.2017.00716

Toh, L., & Watt, H. M. (2022). How do adolescent mathematical self-concept and values explain attainment of different kinds of STEM degrees in adulthood?. *Contemporary educational psychology*, *69*, 102057.