

Play × Discuss: A Digital Cooperative Discussion Game About Women in Science

Chrysa Bika^{1,i}, Shobhana Narasimhan^{2,3,ii}, Johannes V. Barth^{1,iii}, Gudrun Klinker^{1,iv}, Daniel Dyrda^{1,v}

¹Technical University of Munich, Munich, Germany

²Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru, India

³International Centre for Theoretical Sciences, Bengaluru, India

ⁱchrysa.bika@tum.de, ⁱⁱshobhana@jncasr.ac.in, ⁱⁱⁱjvb@tum.de, ^{iv}gudrun.klinker@tum.de, ^vdaniel.dyrda@tum.de

Abstract—This paper presents a design approach for educational games that use structured peer discussion as a primary game mechanic to address the complex, context-dependent challenges faced by women in STEM. We introduce *Play × Discuss: Women in Science*, a digital multiplayer game developed through a human-centered, co-design process involving female scientists from diverse backgrounds. Combining interactive storytelling with collaborative discussion, the game creates a safe, inclusive space for players to reflect on real-world experiences, share strategies, and build community. The resulting game offers a replicable model for designing educational games that foster critical thinking and social connection around key themes of Diversity, Equity, and Inclusion.

Index Terms—Game Design, Educational Game, Serious Game, Diversity, Equity, Inclusion, Women in Science, STEM.

I. WOMEN IN SCIENCE

Persistent gender-based inequalities remain prevalent in society, including the area of science, technology, engineering, and mathematics (STEM) [1], [2]. Addressing these disparities is central to global initiatives such as the United Nations’ Sustainable Development Goals (SDGs) [2], [3]. Goal 4 emphasizes the importance of inclusive and equitable quality education, while Goal 5 focuses on achieving gender equality and empowering all women and girls [3]. These goals underscore the necessity of addressing systemic inequalities, particularly those affecting women in STEM fields [2].

Achieving gender equality in science requires both systemic reform and individual growth. Educational games offer a promising medium to support this dual approach. Unlike passive media, games actively engage players through narrative, interactivity, and structured objectives [4], [5]. Research shows that well-designed elements—such as cooperation, meaningful choices, and storytelling—can foster reflection, motivation, and deeper engagement with complex topics [6], [7].

A. The Game Design Challenge

Traditional games often feature well-defined challenges with clear solutions [4], [5]. In contrast, socially embedded issues—such as gender inequality in STEM—are complex, context-dependent, and lack universal answers. These issues are shaped by personal experience, identity, and social context.

Designing a game around these themes requires a different approach: one that enables players to navigate ambiguity, explore multiple perspectives, and reflect on their own values and experiences. Instead of prescribing solutions, the game must create a “question space”—a structured environment that encourages exploration of diverse perspectives, supporting players in forming their own positions. Designing such a system poses unique challenges for game design: *How can we design an educational game that meaningfully addresses the complex and context-dependent challenges faced by women in STEM in the absence of universal solutions?*

B. Our Approach: Discussion as a Game Mechanic

Our design centers *discussion* as the primary game mechanic. Drawing inspiration from structured peer consultation [8], [9], the game presents nuanced scenarios that prompt collaborative exploration. Rather than delivering fixed outcomes, it facilitates open-ended, guided discussions that encourage the exchange of experiences, critical reflection, and the co-construction of strategies. Players follow a structured narrative while maintaining autonomy in how they interpret and navigate challenges. By positioning discussion as the core mechanic, the game shifts the game’s function from knowledge transmission to co-creation. It becomes a catalyst for dialogue, peer support, and collective empowerment.

C. Related Work

We build on prior work in educational game design, digital storytelling, peer consultation, and discussion-based games.

1) *Games for STEM*: Games show potential in motivating girls and women to pursue STEM careers [6], [10]. *FemQuest*, for example, demonstrates the impact of multiplayer workshops on engagement in computer science [6]. Research highlights the role of affective factors—such as empathy, belonging, and the presence of relatable female characters—in shaping positive attitudes toward STEM [6], [11].

2) *Digital Storytelling*: Digital storytelling enables players to share personal experiences, even around stigmatized topics. Sien & McGrenere [12] use this technique in mental health contexts to encourage open dialogue. Other research shows that even commercially developed games can offer emotional support and coping strategies during difficult times [13].

Short Paper

3) *Peer Case Consultation*: Peer case consultation is a structured peer support method for collaborative problem-solving and reflection [8], [9]. It involves guided phases of group-based exploration to develop actionable strategies and has been adapted across professional domains. O’Leary *et al.* [14] apply peer support systems in mental health contexts.

4) *Discussion-Based Educational Games*: Several educational games embed discussion as a central mechanic.

The Dilemma Game [15] is a serious game designed to foster critical reflection and discussion around research integrity and professionalism. Through realistic ethical dilemmas with multiple response options, the game encourages participants to consider, defend, and potentially revise their decisions in a dialogic setting, promoting a culture of responsible research.

PlayDecide [16], [17] is a serious card game designed to foster respectful, fact-based group discussions. It provides participants with the opportunity to engage with a specific topic, consider diverse viewpoints to refine their own positions, and work toward mutual understanding or shared consensus. The game was applied in the context of various topics, including patient safety [18], adolescents’ perspectives on personal and societal responsibility for childhood obesity [19], and workplace bullying and harassment for junior doctors [20].

The *STEM Women Cooperative Card Game* [21], as part of the *Hypatia* toolkit, engages teenagers to learn about women’s contributions to science. Matching portraits and achievements, it encourages discussion and introduces female role models, promoting inclusive communication and diversity in STEM.

II. THE GAME

Play × Discuss: Women in Science is a digital, cooperative discussion game designed to foster meaningful conversations about women in STEM. Its primary audience is early-career female scientists, with secondary groups including allies.

The narrative framework was co-designed with experts and individuals with lived experience in the field, embedding key themes of Diversity, Equity, and Inclusion (DEI). Guided by illustrated fictional characters (Figures 1 and 3), players progress through structured, story-driven sessions that prompt open discussion and shared reflection. The game uses a dual-layered approach [12]: it presents fictional narratives rooted in real accounts while inviting players to share their own experiences. This fosters both emotional engagement and personal relevance. Designed for groups of 2–6 players, the game is played around a shared table, with each player using a personal device. It supports both facilitated and self-guided play. While early iterations relied on moderators for pacing and discussion flow, built-in prompts and reflective cues now enable autonomous group play. By centering discussion as the core game mechanic, it shifts from an educational game of knowledge transmission to one of co-creation, encouraging critical reflection, empathy, and collective empowerment.

A. Game Content and Structure

The game is structured into three sessions—each lasting 60–120 minutes—following a consistent design principle:

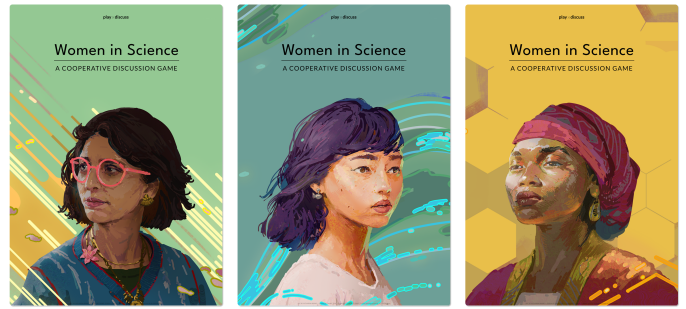


Fig. 1: The posters of the three game sessions. (Art by Katharina Brand. Design by Daniel Dyrda.)

structured narrative elements guide players, while open discussion remains central to gameplay. Interactive components—such as riddles, choices, and branching storylines—serve as prompts to spark reflection, exchange experiences, and co-create strategies. Figure 1 presents the session posters, while Figure 2 provides impressions from the game sessions.

1) *Session 1—Unconscious Bias*: The opening session introduces the concept of unconscious bias in academic contexts. Through quizzes, mini-games, and riddles, players uncover subtle biases that shape everyday decisions. Each activity is followed by guided group discussions, encouraging reflection on how such biases may appear in their own environments. This session serves to raise awareness, establish group dynamics, and lay the foundation for deeper conversations.

2) *Session 2—Penelope’s Story*: The second session centers on an interactive narrative following Penelope, a fictional student beginning her academic journey. Based on real-life accounts, the story presents scenarios involving common challenges faced by women in STEM—such as microaggressions, exclusion, and sexual harassment. Players collaboratively decide how Penelope responds at key moments, using each dilemma as a prompt for group reflection.

3) *Session 3—Career Strategies*: The final session shifts to strategies for resilience and career development. Drawing from interviews and prior workshops with scientists, the game presents real-world coping mechanisms—such as mentoring, boundary-setting, and network-building. Players evaluate these strategies, reflect on their relevance to their own paths, and share experiences. The session emphasizes peer learning, mutual support, and the co-creation of actionable insights.

B. Human-Centered Design Process

Given the game’s focus on real-world experiences, we employed a human-centered design process grounded in co-creation, iteration, and continuous feedback. Across all development stages—from initial content gathering to late-stage playtests—we worked closely with the target audience, subject-matter experts, and fellow designers. This process ensured that the game’s narratives, mechanics, and visual language remained authentic, inclusive, and emotionally resonant.

1) *Ethical Considerations*: For our human-centered design process, we paid attention to ethical considerations. Participants of design workshops and game playtests signed an

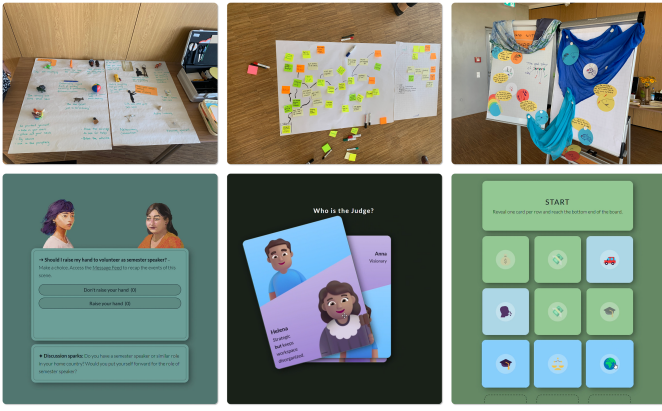


Fig. 2: Impressions from the content workshop (top) and the digital game (bottom). (Art by Katharina Brand. Fluent Emoji by Microsoft.)

informed consent form upon arrival. They were thoroughly informed about the structure and contents. A debriefing session was conducted before thanking and dismissing players.

2) *Initial Content Workshop*: To define core themes, we conducted a two-day content workshop with 23 female and six male scientists from diverse cultural and disciplinary backgrounds. Participants included professors, early-career researchers, historians of science, game designers, and a drama therapist from countries including Argentina, Croatia, India, Italy, Germany, Zimbabwe, Nigeria, the Philippines, the USA, Ukraine, Romania, and New Zealand. Through storytelling exercises and participatory discussions, we collected personal narratives and identified common challenges women in STEM face—such as isolation, exclusion, and structural inequality. Drama and dialogue methods helped to surface strategies for navigating these challenges. In a public session, researchers from the Global South shared personal insights into their scientific work, highlighting that while the intellectual rewards of research are universal, women scientists in these regions often face a compounded burden of limited resources, sexism, and racism. Together, we shared, discussed, and developed strategies to overcome these challenges. We gathered and clustered the input of participants and chose prevalent areas of interest. Insights from this workshop directly informed the narratives, topics, and discussion prompts used in the game.

3) *Ongoing Co-Creation*: Throughout the design process, we collaborated with individuals from underrepresented communities to shape the game’s content and characters. For example, to develop the protagonist of Session 3, we interviewed women from Ghana and integrated their lived experiences into the narrative. Visual elements—such as clothing, accessories, and color palettes—were co-designed with our (female) illustrator, drawing on input from workshop participants to ensure cultural authenticity and emotional resonance.

4) *Playtests*: To inform our development process, we conducted six structured playtests with members of the target audience—primarily early-career female researchers and students in STEM. Early playtests were fully moderated, allowing us to observe how players engaged with the game and where

additional guidance was needed. Over time, we reduced the role of facilitators as the game evolved to support self-guided play through built-in prompts and feedback mechanisms. Playtests spanned analog and digital prototypes. Participant feedback directly shaped adjustments to narrative pacing and discussion prompts. Across iterations, we evaluated not only usability but also emotional impact and group dynamics.

5) *Expert Feedback & Developer Events*: In parallel, we presented the evolving game design at five professional gatherings, including indie game developer meetups and game developer conferences. These sessions enabled peer feedback from experts in game design. Discussions reinforced our commitment to discussion as a core mechanic and helped refine the game’s interface, narrative flow, and technical implementation.

6) *Final Workshop & Public Presentation*: We presented the game to an international audience at our institution’s annual meeting and tested it with students in a dedicated 1-day workshop. The players’ self-reported mood indicated that they felt safe and empowered and that the game fostered meaningful discussions in which they felt seen and heard. Overall feedback was highly positive, with many expressing a desire to continue playing and to try the game in different group constellations.

Overall, we identified the human-centered design process as a key factor in the successful development of the game. This process ensured that our game reflects the lived experiences of its players while providing a structured, supportive, and engaging space for collective reflection and empowerment.

III. DISCUSSION

Designing a game that centers discussion—particularly on sensitive topics such as discrimination—poses unique challenges. A key tension lies in supporting emotionally complex conversations without relying on external facilitators. While our system embeds trigger warnings and structured prompts to guide players, it ultimately places responsibility for moderation in the hands of the players themselves. Nonetheless, the peer-driven approach has trade-offs. Without a trained facilitator, emotional reactions, misunderstandings, or microaggressions may go unaddressed. Group dynamics can lead to uneven participation, where dominant voices overshadow quieter ones. However, this model also fosters shared accountability and mutual care. It encourages participants to practice facilitation, empathy, and active listening—skills essential for inclusive collaboration in real-world settings. Time management also emerged as a practical challenge. Ensuring sufficient time for debriefing proved crucial, particularly after emotionally charged sessions. Debriefing helps process experiences, address unresolved tensions, and reflect on key takeaways.

Despite limitations, the approach presents several opportunities and implications. The game demonstrates the potential of educational games to foster critical reflection, dialogue, and community-building within STEM environments. By providing a structured yet open space for navigating ambiguity and discussing lived experiences, the game contributes to a broader cultural shift toward DEI. Rather than offering prescriptive solutions, the game emphasizes exploration, peer learning,



Fig. 3: The character portraits for session two. (Art by Katharina Brand.)

and collaborative sense-making. This is particularly valuable in contexts where often no simple “right answer” exists—supporting participants in developing emotional intelligence, socio-cultural awareness, and essential soft skills.

Finally, the aim is to support early-career researchers in acquiring important soft skills and competencies in order to promote their personal, professional, and academic development. The final workshop highlighted the game’s empowering impact: players reported feeling seen, safe, and eager to continue discussions beyond the formal session. As such, the game can be a valuable tool in academic onboarding, team building, and professional development programs.

Technically, the game was built with modern web technologies and will be released as an open-source toolkit. This enables institutions and developers to adapt and expand the format for different audiences, languages, or content areas. We are also developing *train-the-trainer* materials to support facilitators in implementing the game independently.

IV. CONCLUSION & FUTURE WORK

This paper presents a design approach for educational games based on discussion as a primary mechanic to meaningfully address the complex and context-dependent challenges faced by women in STEM. This involves two key contributions: (1) demonstrating the potential of how structured, peer discussion can serve as a primary game mechanic in educational settings, and (2) showcasing the central role of a human-centered design process tailored to games that address complex societal challenges, including the target audience, subject-matter experts, and fellow designers. By combining interactive storytelling with collaborative dialogue, our game design offers a format for engaging players in critical conversations around DEI. The co-design approach—grounded in lived experiences and iterative feedback—ensures both authenticity and relevance, especially for underrepresented groups in STEM. Encouraged by the strong positive feedback we received, we are planning to evaluate its short- and long-term impact on players through scientific studies. Findings will inform future iterations and guide adaptations to new audiences and topics. *Play × Discuss: Women in Science* provides a foundation toward educational games that do more than convey knowledge—they create space for reflection, connection, and collective empowerment.

ACKNOWLEDGMENTS

We warmly thank Eva Sandmann for her invaluable support. Without her, the project would not have been possible. We are indebted to all contributors: Alina Fetoski, Felix Stieglbauer, Damian Schneider, Paul Hemming, Mary Hardisty, Lorena Kneipp Vitale, Viktoria Kirchleitner, Fabiola Wörter, Chris Kohler, Katharina Brand, Felicitas Pommerening and Ulrich Marsch. We highly appreciate

funding and support from TUM’s Institute for Advanced Study, Gender Equality Office, Talent Management and Diversity Board, School of Natural Sciences, School of Computation, Information and Technology, Gender & Diversity Incentive Fund (TUM Stabsstelle Diversity & Equal Opportunities.)

REFERENCES

- [1] UNESCO Institute for Statistics, “Women in science,” UNESCO, Tech. Rep. Fact Sheet No. 55, 2019.
- [2] S. Huyer, *Is the Gender Gap Narrowing in Science and Engineering?* UNESCO Science Report: Towards 2030, 2015, pp. 85–103.
- [3] United Nations, “The 17 goals – sustainable development goals,” 2015. [Online]. Available: <https://sdgs.un.org/goals>
- [4] K. Salen and E. Zimmerman, *Rules of play: Game design fundamentals*. MIT Press, 2004.
- [5] J. Schell, *The Art of Game Design: A book of lenses*, 3rd ed. CRC Press, 2019.
- [6] M. Holly *et al.*, “Femquest -an interactive multiplayer game to engage girls in programming,” in *2024 IEEE Conference on Games*, 2024.
- [7] A. Toda *et al.*, “A taxonomy of game elements for gamification in educational contexts: Proposal and evaluation,” in *2019 IEEE 19th international conference on advanced learning technologies*, 2019.
- [8] H. W. Franz and R. Kopp, “Die Kollegiale Fallberatung—Ein einfaches und effektives Verfahren zur ‘Selbstberatung,’” *Sozialwissenschaften und Berufspraxis*, vol. 26, no. 3, pp. 285–294, 2003.
- [9] K.-O. Tietze, “Kollegiale Beratung—einfach aus der Ferne, komplex aus der Nähe,” *Organisationsberatung, Supervision, Coaching*, vol. 26, no. 4, pp. 439–454, 2019.
- [10] C. Vaz de Carvalho *et al.*, “Addressing the gender gap in computer programming through the design and development of serious games,” *IEEE Revista Iberoamericana de Tecnologías del Aprendizaje*, 2020.
- [11] H. D. Burns *et al.*, “Girls’ interest in stem,” in *2016 IEEE Frontiers in Education Conference*, 2016.
- [12] S.-W. Sien and J. McGrenere, “A gentle introduction to mental health through storytelling: Design and evaluation of digital human library,” *Proc. ACM Hum.-Comput. Interact.*, 2025.
- [13] S. Mirhadi *et al.*, “Playing through tough times: Exploring the relationship between game aspects and coping strategies during difficult life challenges,” *Proc. ACM Hum.-Comput. Interact. CHI PLAY*, 2024.
- [14] K. O’Leary *et al.*, “‘Suddenly, we got to become therapists for each other’: Designing peer support chats for mental health,” in *Proc. CHI Conf. Hum. Factors Comput. Syst.* ACM, 2018.
- [15] Erasmus University Rotterdam, “Dilemma Game,” Game, 2020. [Online]. Available: <https://www.eur.nl/en/about-university/policy-and-regulations/integrity/research-integrity/dilemma-game>
- [16] Ecsite, “PlayDecide,” Game [Card Game], 2004. [Online]. Available: <https://playdecide.eu/>
- [17] S. Duensing and A. Lorenzet, “Decide evaluation report,” Ecsite, Tech. Rep., 2007. [Online]. Available: <https://www.ecsite.eu/activities-and-services/resources/decide-evaluation-report>
- [18] M. Ward *et al.*, “The co-design, implementation and evaluation of a serious board game ‘playdecide patient safety’ to educate junior doctors about patient safety and the importance of reporting safety concerns,” *BMC medical education*, 2019.
- [19] L. Timotijevic *et al.*, “Adolescents’ perspectives on personal and societal responsibility for childhood obesity — the study of beliefs through ‘serious’ game (playdecide),” *Children & Society*, 2018.
- [20] E. Burke *et al.*, “Playdecide teamwork: a discussion game for junior doctors to explore workplace bullying and harassment,” *BMC Medical Education*, vol. 24, no. 1, p. 1438, 2024.
- [21] Hypatia Project Consortium, “Gender-inclusive ways of communicating stem in science centres and museums: A toolkit,” 2017. [Online]. Available: <https://www.ecsite.eu/activities-and-services/resources/gender-inclusive-ways-communicating-stem-science-centres-and>