A JOURNAL BY SISSA MEDIALAB

PRACTICE INSIGHTS

It's (not) rocket science to think with gender: supporting students to develop confidence in talking about gender through outer space outreach activities

Eleanor S. Armstrong, Doris Erhard, Manuela Gallistl, Sarah Rosenbichler and Christian Klösch

Abstract

"What might our lives in outer space look like in the future? And how will those lives be shaped by gender?" These were the questions that directed students in a science communication activity in the Vienna Museum of Science and Technology in 2024. This Practice Insight reflects on this project and demonstrates how an expansive focus on gender in the long-term engagement project allowed student participants to challenge and pluralize normative masculinities of outer space futures, instead envisaging cosmic lives that supported traditional women's crafts, or gender-inclusive third spaces and city design. Rather than framing "women" and "girls" as the only subject for gender-oriented activities, this project encouraged students and educators to recognize that gender is done many different ways by different groups in societies. The paper provides prompts to readers to support them implementing similar transformations in their own science communication practices.

Keywords

Diversity, equity, inclusion and accessibility in science communication; Women in science; Science centres and museums

Received: 28th April 2025
Accepted: 26th December 2025
Published: 16th February 2026

1 ▪ Introduction

The Vienna Museum of Science and Technology (TMW) is a large science and technology museum in Vienna, Austria. TMW has a broad collection, with diverse artefacts documenting space research in Austria and with wider progress and advances in global space technologies and research. Introduced into the 'Mobility' section of the museum in April 2022, the museum now holds a collection of current and historical space research that relates to Austria. The gallery contains original objects, experiments and information about the significance of Austria's only manned space mission, AustroMIR, as well as materials about Austrian "NewSpace" companies, start-ups, and research institutions that are currently shaping the future of space research — particularly around futures of life in outer space.

TMW also works to raise the profile of Science, Technology, Engineering, and Mathematics (STEM) within Vienna and more widely across Austria for school groups and visiting publics. One of the focuses of the TMW in the recent past has been thematic 'FOCUS' strands that cross-cut collections, exhibitions, and public-facing events. One such strand is the FOCUS GENDER, which tackles how gender fundamentally shapes technoscience within the museum [Gerber, 2020; Armstrong & Gerber, 2023]. This initiative has already shaped public workshop activities at the museum such as 'Women at Work', exhibition display practices such as formerly purple, now silver gender labels throughout the museum, and scholarly investigation into gender and sexuality in science collections. It has also led to founding a museum journal on Gender and Sexuality in STEM collections and cultures, 'insightOut' [Aufreiter & Griesser-Stermscheg, 2023; Gerber & Kühnlenz, 2023].

As with many major European cities, widening inequalities in the outskirts of Vienna (where TMW is located) shape the social lives and community livelihoods in the local area [Kadi et al., 2022]. One focus of the project was to bring together the schools and museum as geographical neighbours to foreground student-participant's scientific expertise. In our Practice Insight we demonstrate how the mechanisms that allowed us to focus on gender through the program were the same ones that supported expansive student participation in bringing their own interests to the project. We show that centring the voice of youth contributors this way also allows us to build social development and cohesion. Against this backdrop, TMW secured funding from the OeAD — Austria's Agency for Education and Internationalization and the Federal Ministry of Women, Science and Research through the 'Sparkling Science 2.0' project, for "This is (not) Rocket Science!", to host an engagement project that brought together five participating schools in Bildungsgrätzl Schönbrunn, three industry and non-profit partners with the Museum.

One of the proposed strands of "This is (not) Rocket Science!" focused on 'Women in Space,' aiming to build student familiarity with both scientific futures of outer space, with the concept of gender, and with the museum itself. This Practice Insight focuses on the authors' work to transition this strand from focusing on 'women' to working with students to understand 'gender' as a social structure. We, the authors, collaborated to develop and deliver year-long, bilingual, workshop programme detailed in this Practice Insight for two school classes, with support from teachers at partner schools. We are an external scholar-collaborator (EA), lead curator of space (CK), lead engagement practitioner (DE) and two workshop delivery practitioners (SR, MG).

In this Practice Insight we show how, by placing gender and the interests of the student-participants at the centre of the project, this activity goes some of the way towards

subverting hegemonic science communication practices that Dawson et al. [2022, p. 5] argue are "heavily framed by the social, cultural and political imaginaries of scientists and politicians, with little scope to question or critique of these processes." As we will detail, this activity allowed students to critique normative visions about future lives in outer space — instead imagining their local cultural practices, social support systems, craft techniques, and bodies at the centre of futures they were creating, which we understand to be working towards "meaningful inclusion" [Dawson et al., 2024, p. 7] in practice.

2 ▪ Rethinking women in STEM? What a focus on gender can offer

Recently JCOM has been host to several texts that grapple with questions about social structures like gender in, and in relation to, the practice and research of science communication. In 2019, Rasekoala argued for a feminist agenda in science communication that grapples with gender imbalances in the profession, harassment, and thinks through the (feminized) status of science communication relative to STEM. Pérez-Bustos [2019] was in conversation with that paper by arguing that the subordination of communication to STEM research it is not inherent in the profession but rather makes visible that the "values and practices associated with that what we consider "feminine" are more central" to science communication over time that changed the field from being one dominated by amateur work by men to one populated by women professionals. These papers call for research into gender in science communication that moves beyond "simplistic head counts" [Rasekoala, 2019] of women and men to practices that instead tackle gender and its intersections in the field, as well as urging practitioners to prioritise "scientific subjectivities" [Pérez-Bustos, 2019] of participants in research and practice. This paper, then, turns to research on what Dawson et al. [2022] describe as "meaningful inclusion" in science communication, that advocates for intersectional feminisms that take account of other social structures in addition to gender (such as race/ethnicity, disability, class etc; for further consideration of intersectional perspectives see Hill Collins, P. and Bilge [2016]); as well as inclusion that calls for making the politics of science communication and associated research more explicit both in research and in practice. This reflects wider turns in research on gender in museums that conceptualize gender as part of structural systems of skills and interests, rather than individual identity [Dancstep (née Dancu) & Sindorf, 2018; Dawson et al., 2019].

Many existing projects on gender in outer space science communication work to highlight current and historic 'women in STEM.' This might be through, for example, exhibitions that champion women's contribution to science in museum exhibitions like "Imagining Women in the Space Age" (New York Hall of Science, USA) and "Defying Gravity: Women in Space" (Intrepid Museum, USA); or tours like "Women in Science" (Natural History Museum, UK). The global publishing industry also participates in this work, with non-fiction texts on histories of women in space research for adult publics (e.g. *Hidden Figures*, Shetterly [2016], later adapted into a film of the same name) and children alike (*Mae Jemison: Little People BIG DREAMS* by Sanchez Vegara [2022]); as well as fiction texts (for example, *Ada Twist, Scientist*, or *The Lady's Guide to Celestial Mechanics*). Many more toy artefacts are produced to encourage girls to understand themselves as scientific, from Mattel's Barbie campaign "I can be anything" that produced astronaut, astrophysicist, and lab scientists among many other dolls; or Lego's *Women in STEM*; as well as scientific toys aimed at girls, STEM out-of-school groups for girls, and a burgeoning industry of video games, activities, and movies on the topic.

However, these actions are limited. They both underplay the social politics that the STEM enterprise is part of — as described in Jester's [2023] analysis of women in STEM arms manufacturers social media and their co-option of neo-liberal feminist narrative styles — and can participate in STEM genderwashing. STEM genderwashing constructs the inequalities in STEM as a problem associated with women (which needs fixing) rather than focusing on the system itself in service of economic not ethical concerns and with a focus on white, middle-class, Global North audiences at the expense of other intersectional identities [Fox-Kirk et al., 2020]. Scholars have highlighted how this happens with STEM enterprises such as Girls Who Code [Smits, 2021], and in reinforcing traditional gender roles and neoliberal values in *My Little Pony* media [Patel, 2019]. Simultaneously, inclusion metrics such as counting the number of women represented do not make visible the ways that representation alone is not enough, as it is possible to reproduce ideas of gendered participation — for example museum exhibitions that frame astronaut men as agential in emergency contexts, with women astronauts doing the same activities rendered as passive, infantilized passengers [Armstrong, 2020]. The focus on girls and women in also further marginalizes communities that sit outside the gender binary, such as trans* and non-binary youth [Rende Mendoza & Johnson, 2024]; and means that learners fail have space to engage with the masculinities that are also being (re)produced within STEM contexts [Cian & Dou, 2024]. Our rethinking of this activity to focus on 'women' to a focus on 'gender' aims to to circumvent reproducing these issues in this project, and instead to focus on the systems and structures that shape STEM and the technoscientific visions of the future.

Moreover, as seen in recent practice insights published in JCOM [e.g. Toyib et al., 2024] practitioners and scholars of science communication describe how outer space appears to offer a uniquely attractive site for drawing communities to STEM education and raising scientific literacy. When focusing on informal learning in relation to outer space, emotions such as 'awe' and 'wonder' have garnered attention [e.g. Valdesolo et al., 2017; Gottlieb et al., 2018]. These narratives are reproduced in (inter)national policies around science communication to do with space. The European Space Agency used inspiration as a guiding feature of their Space for Education 2030 report (released in 2022) that will go on to inform educational activities around space sciences across Europe for the coming years. The report describes space as inspirational; and argues that educators can use the 'wow' factor generated by space to spark children and teenagers' curiosity and imagination. In this project, however, we wanted to circumvent 'awe' as the only experience for learning about outer space science. Instead, as Luna [2021] advocate, we turn towards understanding this and other emotions in out-of-school science learning as locally constructed, socially contingent, and culturally informed; and encouraged youth to bring their own emotional engagements with STEM and outer space in their own lives to the project about outer space.

Thus, we will show in this Practice Insight how our focus on 'gender' rather than 'women' helped students think about the political systems that underpin scientific research and decision making. It made the workshops a place for their developing scientific subjectivities through the possibility of spending time 'feminized' expressions of culture that would otherwise be marginalized in an androcentric field of science communication about outer space. As we go on to describe, youth participants did this by, for example, challenging and pluralizing normative masculinities of space futures, making space for traditional women's crafts, or thinking about how cities are designed to make third spaces safe for people of different genders.

3 ▪ The gender and space workshop: centring youth views of life in space

The workshop program stretched over 7 months, involving two, one-week intensives of collaborative work (5 hours of workshops per school group each time, once in October and again in April), interim zoom meetings with student-participants, and visits to the MakerSpace Lab at TMW by the student-participants. The two classes were split into small groups of 3–5 students, with the aim that each small group would collaborate to make material culture objects that engaged with visions of living on other planets in the future. While the funding from the project did have a pre-formulated focus (life in outer space; gender), the workshop set up allowed student participants to formulate their own questions for their creatively produced artefacts, explore existing collections in the museum, and to bring their own knowledge, background, and experiences into the project.

The objects came about through student-participants posing themselves open-ended project question about life in space that spoke to their own interests, following some group work that set a framework of how to talk about gender, and what we might think about in relation to life in space through two categories: teenhood and childhood (toys, games, clothing, education and schooling); things we care about (looking after each other, protecting our environments and looking after our homes). We asked students to think about the different emotional connections they made to these activities (what makes you feel good about looking after your home? What do you find frustrating about toys you have?); before going and finding objects in the museum display that echoed these different categories of event. Following this, students generated larger questions that they could unpack in their object responses over several months. At each stage we worked to keep the student co-construction of gender at the front of mind.

The objects that students produced were displayed at the Vienna Museum of Science and Technology (Summer 2024) and then latterly, by invitation, at a European Space Agency International Conference in Vienna (Summer 2025), where the student-participants' ideas could go on to shape both other lay publics ideas, and those of scientific practitioners. Each element of the program intertwined the three elements that underpinned the programme: outer space, gender, and the science museum, with every activity or workshop involving at least two of these dimensions. Later in this Practice Insight we describe some of the projects that the student-participants worked on and how they thought about the gender dimensions of their work.

3.1 ▪ *Program of the workshop: (timeline over the year in Figure 1)*

1. **Initial meeting** between students and museum staff at TMW. Focused on student-participants developing questions that they would like to explore answers for about outer space, through a scavenger hunt in the museum, prompt questions on gender in their daily lives, and a question-generation formula activity (see Figure 2).

   Gender Dimension: Initial group discussion for co-construction of what 'gender' was and orienting the scavenger hunt towards items that symbolized gender to the students.

2. **Selection of questions** for group work, and development of ideas about the 'object-response' to their selected question that was the focus of the project. Selected questions included: "What would it be like to be pregnant in space in the future?" "How would we deal with astronauts dying in space?" "What do community spaces look like in future outer space habitats?" We focused with students on the dimensions of gender (social roles, habits, objects, expectations) that would shape the development of their objects (see Figure 3).

    Gender Dimension: All workshop leaders were always focused on prompting students to think about gender in their fictional future society.

3. **Object-response development** saw student-participants begin to ideate and sketch out elements of their anticipated objects (see Figure 4).

    Gender Dimension: The object development worksheets had specific sections on gender for free-form student response; and one workshop leader was always focused on prompting students to think about what their objects expressed about gender in their fictional future society.

4. **Staying connected through an online meeting** which allowed a touch-point for feedback in addition to a digital jam-board, sharpening gender-dimensions of the projects, and adjusting the remaining timeline based on progress.

    Gender Dimension: Asking students to specifically explore gendered elements of their project. Each project was given at least two pieces of feedback by the project lead, one of which was gender-focused to develop how gender could be easily understood by the museum audience.

5. **Object-response construction** where students worked both at school and in the museum Maker Space to do realize their object responses to the questions they posed (Figure 5).

    Gender Dimension: Special boxes that asked student-participants to write or draw about gender were used on all worksheets, and the project team ensured students were filling them out.

6. **Developing an exhibition display** through imagining showing pieces in an exhibition and writing their own labels for displaying the objects. This included a 'behind the scenes' tour of the conservation, label development and printing, and maintenance teams at the museum to show the kinds of roles and consideration that go into exhibitions. Students recorded answers that described their object; wrote exhibition labels for display (see Figure 6).

    Gender Dimension: We talked about how "gender" objects in the museum exhibitions are highlighted, and students had to write two labels, one of which specifically talked about how their object grappled with gender dimensions.

7. **Exhibition opening**, where student-participant objects and their written labels were displayed to other contributors to the "This is (not) Rocket Science!" project (see installation images, Figure 7, Figure 8).

    Gender Dimension: Each object had two labels, one of which explicitly talked about the gender dimension of the object, and matched the museum's "gender" visual language, with silver labels that call out gender-related exhibits in the display.

8. **Visiting the exhibition** was made possible with free tickets for student-participants and family members to come to exhibition at TMW, which several families did in the months following the opening while the exhibition was open over the summer 2024.

    Gender Dimension: Participation in exhibition is shaped by gender where being able to pay to attend and take time off work are shaped by wider systems of gendered inequality. Giving students family tickets aimed to tackle this intersection with financial inequality that also shapes museum attendance.

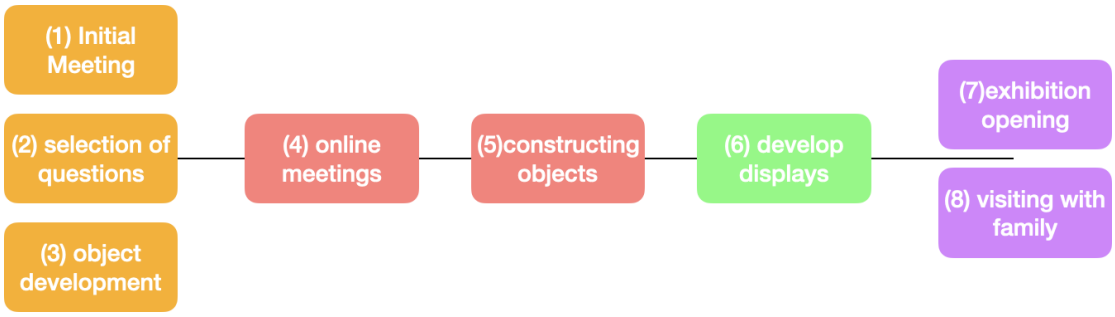

Figure 1. A visual representation of the timeline pathway through the workshop.

The invitation to display these objects at the international symposium in 2025 arrived after we had conceptualized these stages. The exhibition in step (7) was re-displayed and, as with step (8) in the museum, students who contributed to the exhibition were invited to go to their exhibition at the symposium.

Figure 2. Students participate in gender-based scavenger-hunt of the museum.

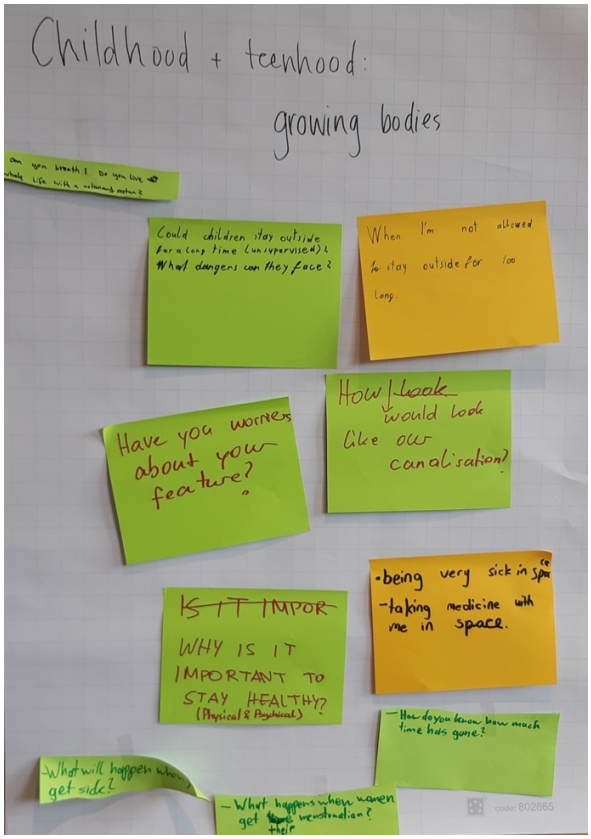

Figure 3. Students generate many questions on the themes, to select one to answer in their object.

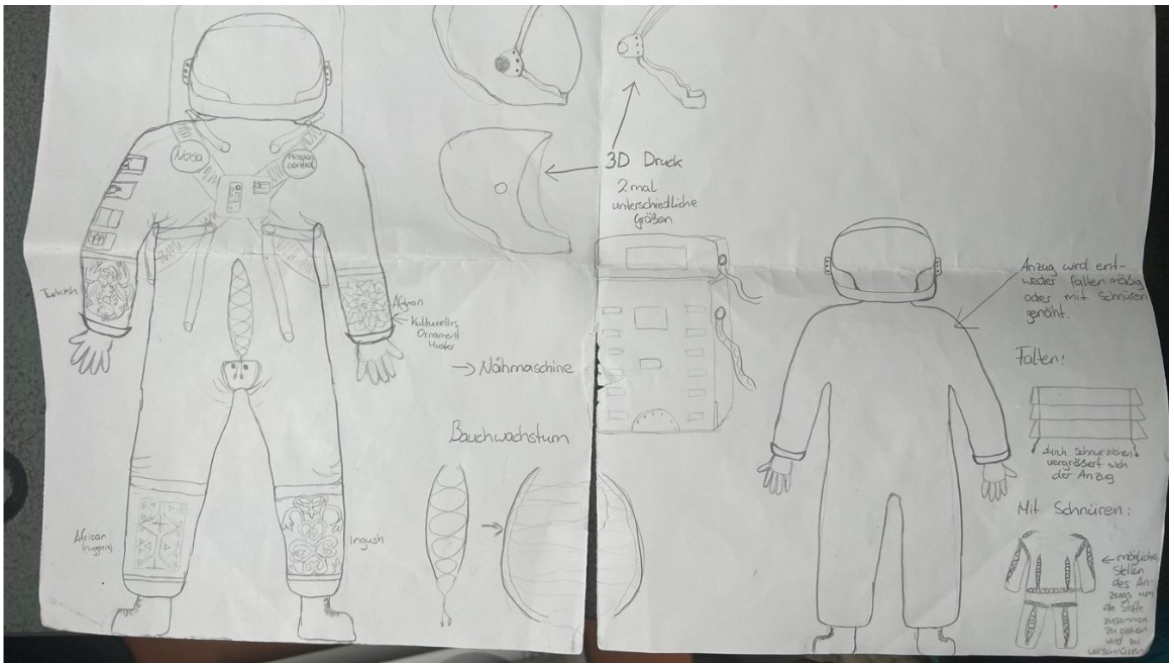

Figure 4. Students sketch out ideas for their object development.

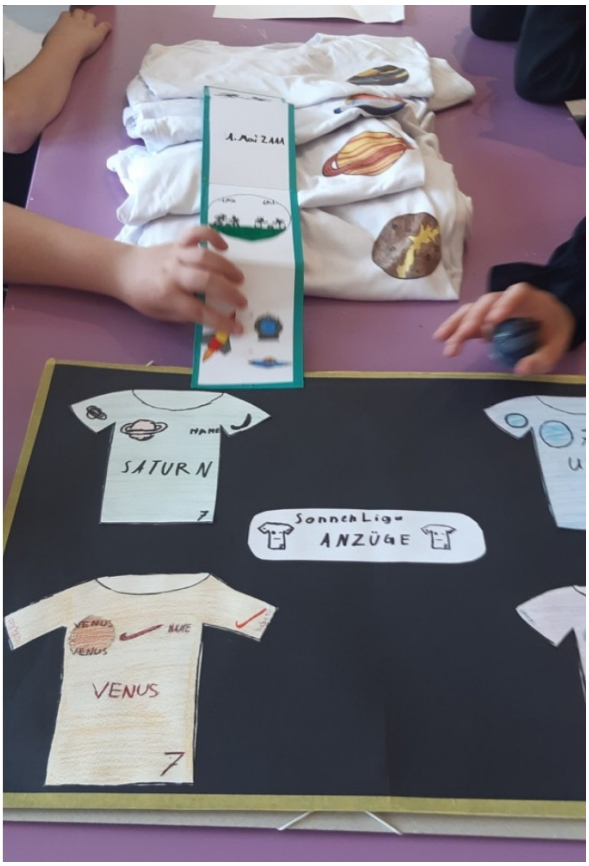

Figure 5. Student make their objects in classroom sessions, and at the MakerSpace Lab at TMW under guidance from the makers and education team.

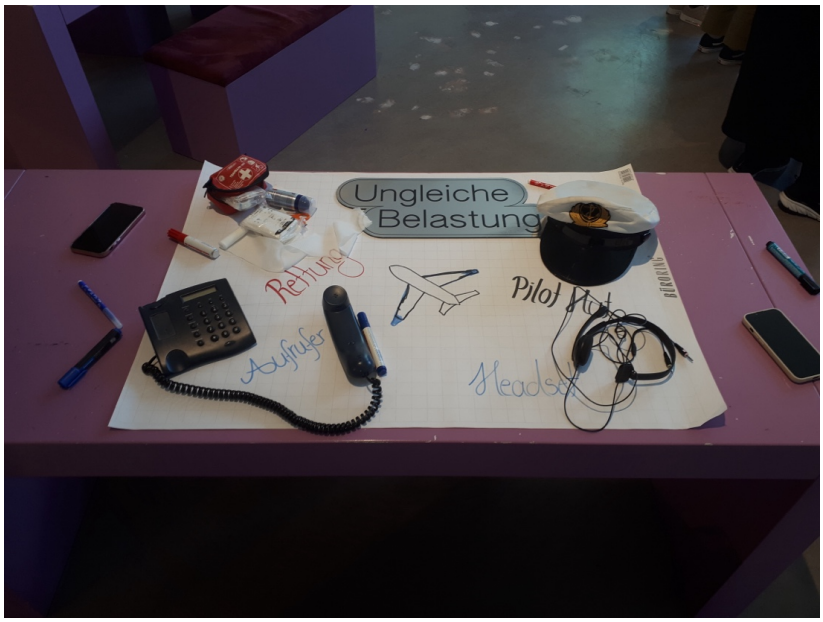

Figure 6. Students begin exploring what it means to display objects in museums thinking about labelling, and engagement through a creative workshop activity.

Figure 7. Two student projects on Display in TMW exhibition 'ALL-daily lives' during summer 2024

Figure 8. Student projects on display, you can see the silver sign on the top shelf that marks “FOCUS GENDER” objects across the museum highlighting the student-participant work.

Table 1. This table highlights some of the projects produced by students, with description and content and how the projects link to gender dimensions. Where there is quoted material from the students, these are from descriptions for the exhibitions labels that they authored.

Title	Description	Gender Dimension
"What would Pregnancy in space look like?"	Model of two space suits; made by hand with five technical layers that provide waterproofing. One for a pregnant adult had an expandable area of the abdomen. The spacesuit for a child had extendible parts to accommodate the growth of the child. The adult suit was embroidered with four patterns from communities in places like Ethiopia and Sudan, which spoke to the cultural heritage of the students participating in the project.	Students engaged with two dimensions of gender: embroidery and feminized intangible cultural heritage; and designing for the changing pregnant body. Four different embroidery patterns on each of the limbs represented the heritage of each student, and was contrasted to the more masculine, militarized history of mission patches. The flexibility of these suits also emphasized the need to consider the changing body as well as more petite frames.
An Inter-planetary Football League	A football league that spans planets — each team has a logo representing their team; as well as a pamphlet explaining the structure of the league, the different teams and the types of practices and matches that astronaut-footballers would have to participate in.	This group have thought both about the practicalities of socializing in outer space, what they see as important aspects of social groups, which communities they want to be a part of, and what their values are. Focusing on gender makes sure that we talk about boyhoods and the expectations on men and masculinities shaping what is taking place in about outer space.
School on the Moon	Model of a moon school, which a curriculum that foregrounds community, life skills, and intergenerational learning and collaboration	Students wrote that "Instead of highlighting individual astronauts, our school emphasizes community and collaboration" as a gendered practice that values overlooked feminised traits.
Space City	Model of public space in a space city under a public dome where the housing gives a view on a park. Students wrote: "we wanted to emphasize the role of nature" and used visual prompts to do so — colouring the architectural infrastructure grey and highlighting the colours of the natural world.	Public space is highly gendered —where experiences of privacy, safety, or freedom for movement are shaped by a person's social position and other people's thinking about them. The students' focus on nature also foregrounded the horticultural/agricultural work that would maintain this, which is often undervalued in modern society.
Corpse transport capsule	Answering the question 'what happens when someone dies in space' this group thought about the religious and cultural rites that happen around death and bodies on Earth and proposed a capsule that brought the deceased back to Earth outside the main portion of the spacecraft while others could continue living their lives.	The focus on how both astronauts and Earth-based relatives would cope with grief and other emotions of death engaged the idea of traditions and spirituality which are unusual consideration in the context of life in outer space. Students engaged with the feminized idea of emotional management in the context of space.

4 ▪ Museum research team reflections and insights drawn from student work: Shifting the focus to gender in science communication and public engagement

Members of the museum research team engaged informally with student participants during the exhibition launch; however, these interactions were not systematically recorded or included as part of the formal data collection. The primary data sources for this analysis consist of museum researcher reflections and student-authored exhibition texts, which—apart from minor copyediting—represent the students' original ideas. This approach aligns with the exploratory and student-led nature of the activity. In Table 1 we describe some of the objects that were realized by the student-participants. These summaries for the reader are based on the texts that students wrote, museum worker discussions with the student-participants, and reflections by museum team. The information underpinning Table 1 forms the primary data of our reflections, and the basis for the recommendations that follow.

4.1 ▪ *Working to make space to talk about gender*

Our opening workshop focused on talking with students about 'gender' rather than 'women,' bringing their own knowledge into the framework. This focus on gender also cast a light on non-binary or gender-queer lives where people reject normative gender roles; and make space for young people to discuss gender more expansively in relation to their own lives. Before starting the discussion, students provided their own knowledge about gender-terms in small group discussions, which we the museum team supplemented in both German and English to build a shared definition. This worked well with both age groups, and many students were clearly familiar with ideas of non-binary and trans identities and terms, as well as stylistic representations such as the "*" in gendered German terms.

The opening session then focused on gendered activities in society such as 'Social Issues and Care' that are underrepresented within outer space discourses [Gál & Armstrong, 2023], including themes about caring for the environment, caring for each other, and live trajectories from birth and death. Some of these were easier for the students to grasp — especially the ones that were closer to their own lives — and this can be seen in the spread of projects (Table 1); and certainly, the connection of the themes to gender was more difficult. For example, student-participants struggled with describing gendered dimensions of death and grieving but were able to draw on their own culturally situated practices of grieving community at a distance to create caring death rituals that foregrounded the fragility of life and community in imagined space contexts.

Rather than positioning workshop leaders as knowers, we ensured student-participants saw themselves as epistemic agents; and foregrounded student-participants' own experiences of gendering through our 'Youth and Childhood' theme which looked at the hobbies, social communities that they participated in and how those might be reshaped by living in space. From these two themes (social issues and care; youth and childhood) the student-participants generated their own research questions about gender might shape future lives in outer space.

We also showed the student-participants that the TMW was thinking about exhibits related to gender the same way: we highlighted displays with the museum's silver "gender" tag and

labelling to engage with gender; we had a copy of this 'FOCUS GENDER' label in the workshop space with the students, and (as can be seen in Figure 8) used the same system labels highlighting gender dimensions within the student displays in addition to their own descriptive labels which situating their objects as part of a wider discourse at the museum.

Recommendations to implement in your own activities:

- Participants in your workshop likely already know about gender — make space for their knowledge, experiences, and understandings in creating a shared definition of the term. Talk about the words we use to describe different ideas of gender at age-appropriate level,
- Make Gender a focus in the final part of the activity — highlight their engagement with it and situate it alongside other work that is done in the institution, and possibly link it to wider activities within that country that address gender.

4.2 ▪ *Structure activities for repeated returns to gender through the workshop*

In order to keep our co-construction of gender in focus throughout the eight months of the program we ensured that each step of the program brought our participants back to questions of how they understood gender. This included (but was not limited to):

- Getting student-participants to talk about how they saw gender in the museum collections; and to take pictures of gender labels,
- A focused box in the initial 'planning' worksheet that focused on the gender-dimension of their object as described by students with support from workshop leaders,
- Asking student-participants to show gender-oriented elements of their objects in an online show-and-tell, supporting them to develop deeper and richer articulations of what they were doing by showing them examples from the wider world,
- Writing two parts to the labels for their displays: one that is general, one that focused specifically on gender where student-participants in their own words talked about how they had expressed gender.

Throughout the project we came back to our initial, co-created conceptualization of gender from the first session; and worked with student-participants to use it in articulating the gendered dimensions of both the questions they developed and the object-based explorations of that question that they offered. In reflecting on their priorities, questions, and contributions as we show in Table 1; we note that across these projects the students valued safe and inclusive places to live, opportunities to be "among themselves" with youth of their own gender, including diverse bodies and their growth in space futures, and looking for more equitable futures with less gendered expectations on the individual.

While students worked within this framework, there was some hesitancy from teachers and workshop leaders. Moments of resistance around talking about masculinities were particularly interesting — where developing the student football projects, for example, staff struggled to connect with gender-dimensions of this; while student-participants talked enthusiastically about the need for spaces like football teams to bond with peers. Within the museum team we spent time in advance of the workshops during the planning developing a

shared understanding of why gender mattered in these contexts and drew on expertise from other personnel in the museum who worked on the FOCUS GENDER strand; and we reflected that it would have been beneficial to include the staff and teachers from schools in this workshopping to understand both more about the student knowledge and also share our grounding with them as collaborators in supporting the student-participants.

Recommendations to implement in your own activity:

- Focus on different touch points in each activity that give student-participants space to develop their understanding of gender — give participants different opportunities to explore it (talking, taking pictures, reflecting on their own lives, talking about other peoples' lives), and if there aren't resources within the institution, consider using online searches, or asking students to bring in/sketch objects that they own and use that express gender,
- Co-create understanding of gender, and return to the co-developed conceptual framework with participants throughout the project. With younger student-participants more of this co-creation might need to come from the project team initially, but ensure that over time student-participants are expressing their own ideas.

4.3 ▪ *Expansive femininities, masculinities and genders beyond the binary in focus*

We foregrounded from the start how gender is created and reinforced in the structures our societies, such as the social roles people are expected to take on or expectations about occupations. We talked about how these are geographically, and temporally distinct. We also encouraged student-participants to see these social roles in their own world, explicitly talking about their teenage lives, girlhoods and boyhoods. This shift made it possible for us to highlight masculinities of STEM, destabilizing the idea that 'men' are a neutral category against which 'women' should be compared. As masculinity studies Kishonna L. Gray argues, masculinity as a part of gender relations "structures large-scale institutions, economic relationships, and sexuality… [as well as] objects, symbols, gestures, places, and spaces" [Gray, 2018, p. 107] just as much as femininity is, and work that focuses on only women in STEM can create an unbalanced view of systems at play.

This shift to highlighting masculinities led to students led to students thinking about activities for boyhoods in space (such as interplanetary football competitions); the differently gendered expectations of grief and death (clothing that signalled mourning for astronauts to wear; returning bodies for burial with community; connecting and supporting distant family through death of a loved one); as much as the experiences of pregnancy in clothing for outer space. Similarly, by focusing on how gender was geographically expressed, some groups brought elements of their own cultures such as culturally specific, feminized, weaving patterns into the objects they created. This was especially important when contrasted to the western masculinities of space cultures that homogenize gender expressions.

Recommendations to implement in your own activity:

- Consider how to ensure that different femininities and masculinities that are locally and culturally relevant are talked about within the workshop — showcase different groups, and talk about roles, expectations, outward expression rather than only highlighting individual women in STEM, to make these differences and the wider systems visible,

- Encourage specificity in the project — can participants create attentive ideas about what genders are being explored in these projects that address their context rather than speaking to a globalized vision of (often white, cis-heterosexual) gender expressions?

4.4 ▪ *Maximising student engagement in gender themes for different age groups and encouraging multilingual participation*

Student-Participants in the groups were part of classes at schools that had agreed to participate, not selected through their interest, and so we here reflect on two ways that this shaped their participation in the project. We found that in the older student cohort some student-participants were less engaged as they were working towards exams, but the idea of exhibiting their work did encourage all student-participants to finish their projects. In the younger age group, once given the space to exploring the activities that the younger boys saw as part of their gendered childhoods as constituting 'gender' based activities for this project, the student-participants enthusiastically created new worlds for their football teams that were disability-inclusive and gender diverse through this more open-ended way into the activity.

In terms of language use, the groups of students were mixed — some had greater familiarity with English than German, and many spoke three or four languages. Delivery in multiple languages meant that some student-participants (especially younger student-participants) who had struggled with German instruction enthusiastically conversed in English. We encouraged student-participants to bring their cultural backgrounds and knowledge to the workshop too, which was in part facilitated by this multilingual context. Most facilitators spoke English and German (but not any additional third languages). We encouraged conversation in any language — and frequently encouraged the student-participants to draw on their own interests: in the scavenger hunt, in creating the questions, in realizing their designs, and in describing their projects for the labels.

Recommendations to implement in your own activities:

- Start from student-participant knowledge of gender concepts — even at the younger age students had more knowledge that what some on the museum team expected. What activities beyond discussions could you do to meet the student-participants where they are in their knowledge?
- Inclusive terms are needed in different languages, and this supports student-participants who might use loan words or have greater familiarity in different languages to be part of the conversation. Additionally, languages with gendered structures (such as German) have different challenges student-participants might need to grapple with. How can you include these differences in the discussions you have, and show that even thinking about gender is different in different languages?

5 ▪ Conclusion

This project demonstrates the possibility of moving from framing 'women in STEM' as individuals that participants can engage with; to thinking about how systems of science are shaped by and shape gender in society. The objects produced by student-participants to think about what life in outer space might be like for youth show attentiveness to gender in

their own lives, as well as engagement in science fiction creativity — both of which develop skills that are important for scientific production.

Our approach to integrating gender into the workshop design represented a deliberate and innovative strategy to foster more equitable and inclusive science communication practice, moving away from practice largely emphasizes 'women' (or 'girls') as a category of interest, highlighting the careers of women, or offering girls and young women a space to engage with STEM fields outside of pervasive social norms in mixed gender education contexts [see for example, Gonsalves et al., 2022] Instead, our expanded focus on gender allowed us talk with student-participants about gender as a system of expectations and acts rather than innate properties of individuals.

This offered a pathway for more equitable inclusive practice in our workshop. Drawing on reflections from this activity and student-produced texts, we identified key insights and practical considerations for others seeking to embed gender as a central theme in their engagement work. We highlight four interrelated strategies: making space to talk about gender, bringing the gender theme back throughout the workshop with the student-participants, ensuring to talk about structures of femininities/masculinities and genders beyond the binary, and creating a multi-lingual, age inclusive workshop.

Future iterations of this project would aim to collect this data to better understand the student voice. For example, we used student-participants recording answers to questions about their objects to help write the captions for the exhibition, and in the future, we could include short feedback questions at this point that would capture the student-participants ideas and perspectives about the project. Something similar would be possible in recording the end sections of the existing online meetings while asking students to reflect on their participation. Other data-driven approaches could include written feedback from student-participants and the organiser-participants from their schools; detailed ethnographic fieldnotes from the museum organisers at the time of delivery, and survey data for visitors who saw the exhibition at the museum or the European Space Agency Living Planet Symposium. All these cases would require ethical approval from student-participants and their caregivers, which we recommend future projects ensure there is time to secure.

Acknowledgments

This project was supported by the OeAD — Austria's Agency for Education and Internationalization and the Federal Ministry of Women, Science and Research 'Sparkling Science 2.0' funding (2022). The 'Gender' part of the project "This is (not) Rocket Science!" on which this paper is based was delivered in collaboration with two schools in Vienna's 15th district. We thank the teachers, administrators and above all the students for their enthusiastic participation in the project. The authors are also grateful to other staff at the Vienna Museum of Science and Technology without whose support the ideas and delivery of these projects would not have been possible. Thanks to the reviewers for their insights on the paper. Any remaining errors are the authors.

Author contribution to the manuscript: Armstrong led on the writing of the paper (original draft, revisions), remaining authors who primarily contributed to the production of the event and collection of data are listed alphabetically.

References

Armstrong, E. S. (2020). *Exploring Space (s): Queer feminist approaches to understanding pedagogy in science museum galleries* [Doctoral dissertation]. University College London (UCL). https://discovery.ucl.ac.uk/id/eprint/10107417

Armstrong, E. S., & Gerber, S. (2023). Practice Spotlight: Outer Edge: Queer(y)ing STEM Collections – A Community Workshop. In *Queering Science Communication* (pp. 178–180). Bristol University Press. https://doi.org/10.51952/9781529224436.ch026

Aufreiter, P., & Griesser-Stermscheg, M. (2023). Foreword. *insightOut. Journal on Gender & Sexuality in STEM Collections and Cultures*, 5–6. https://doi.org/10.60531/INSIGHTOUT.2023.1.1

Cian, H., & Dou, R. (2024). Masculinized discourses of STEM interest, performance, and competence that shape university STEM students' recognition of a "STEM person". *Journal of Research in Science Teaching*, *61*(5), 1062–1092. https://doi.org/10.1002/tea.21937

Dancstep (née Dancu), T., & Sindorf, L. (2018). Creating a Female-Responsive Design Framework for STEM exhibits. *Curator: The Museum Journal*, *61*(3), 469–484. https://doi.org/10.1111/cura.12268

Dawson, E., Archer, L., Seakins, A., Godec, S., DeWitt, J., King, H., Mau, A., & Nomikou, E. (2019). Selfies at the science museum: exploring girls' identity performances in a science learning space. *Gender and Education*, *32*(5), 664–681. https://doi.org/10.1080/09540253.2018.1557322

Dawson, E., Hughes, S., Lock, S. J., & Wahome, M. (2022). Exploring the politics of science communication research: looking at science communication from a social justice perspective. *JCOM*, *21*(07), C05. https://doi.org/10.22323/2.21070305

Dawson, E., Iqani, M., & Lock, S. (2024). Why should we think about social justice in science communication? *JCOM*, *23*(04). https://doi.org/10.22323/2.23040501

Fox-Kirk, W., Gardiner, R. A., Finn, H., & Chisholm, J. (2020). Genderwashing: the myth of equality. *Human Resource Development International*, *23*(5), 586–597. https://doi.org/10.1080/13678868.2020.1801065

Gál, R. P., & Armstrong, E. S. (2023). Feminist approaches to outer space: Engagements with technology, labour, and environment 1. In *The Routledge Handbook of Social Studies of Outer Space* (pp. 158–171). Routledge. https://www.taylorfrancis.com/chapters/edit/10.4324/9781003280507-15/feminist-approaches-outer-space-r%C3%A9ka-patr%C3%ADcia-g%C3%A1l-eleanor-armstrong

Gerber, S., & Kühnlenz, S. (2023). De-constructing Food: Thoughts on the Feminist and Queer Perspectives on Food Workshop. *insightOut. Journal on Gender & Sexuality in STEM Collections and Cultures*, 13–18. https://doi.org/10.60531/insightout.2023.1.2

Gerber, S. (2020). Labelling Machines and Synthesizers: Collecting Queer Knowledge in Science and Technology Museums. *Museum International*, *72*(3–4), 116–127. https://doi.org/10.1080/13500775.2020.1873501

Gonsalves, A. J., Johansson, A., Nyström, A.-S., & Danielsson, A. T. (2022). Other spaces for young women's identity work in physics: Resources accessed through university-adjacent informal physics learning contexts in Sweden. *Physical Review Physics Education Research*, *18*(2), 020118. https://doi.org/10.1103/physrevphyseducres.18.020118

Gottlieb, S., Keltner, D., & Lombrozo, T. (2018). Awe as a Scientific Emotion. *Cognitive Science*, *42*(6), 2081–2094. https://doi.org/10.1111/cogs.12648

Gray, K. L. (2018). Masculinity Studies. *Feminist Media Histories*, *4*(2), 107–112. https://doi.org/10.1525/fmh.2018.4.2.107

Hill Collins, P. & Bilge, S. (2016). *Intersectionality*. Polity press.

Jester, N. (2023). Making martial politics palatable: constructing neoliberal feminist subjects in arms manufacturers' social media feeds. *International Feminist Journal of Politics*, *25*(2), 310–333. https://doi.org/10.1080/14616742.2023.2174154

Kadi, J., Banabak, S., & Schneider, A. (2022). Widening gaps? Socio-spatial inequality in the "very" European city of Vienna since the financial crisis. *Cities*, *131*, 103887. https://doi.org/10.1016/j.cities.2022.103887

Luna, D. S. (2021). *The nature of awe in science communication* [Doctoral dissertation]. University of Otago. https://hdl.handle.net/10523/12476

Patel, J. (2019). *Painting the Leaky Pipeline Pink: Girl Branded Media and the Promotion of STEM* [Master of Arts in Communication (MA)]. University of Arkansas. https://scholarworks.uark.edu/etd/3158/

Pérez-Bustos, T. (2019). Questioning the feminization in science communication. *JCOM*, *18*(04), C04. https://doi.org/10.22323/2.18040304

Rasekoala, E. (2019). The seeming paradox of the need for a feminist agenda for science communication and the notion of science communication as a 'ghetto' of women's over-representation: perspectives, interrogations and nuances from the global south. *JCOM*, *18*(04), C07. https://doi.org/10.22323/2.18040307

Rende Mendoza, K., & Johnson, C. C. (2024). A (TRANS)formative approach to gender-inclusive science education. *Journal of Research in Science Teaching*, *61*(4), 937–971. https://doi.org/10.1002/tea.21928

Sanchez Vegara, M. I. (2022). *Mae Jemison* [with Morton, J.]. Quarto Publishing Group UK.

Shetterly, M. L. (2016). *Hidden figures: The American dream and the untold story of the Black women mathematicians who helped win the space race*. William Morrow.

Smits, Z. (2021). *Analyzing the discourse of Girls Who Code concerning gender inequality* [Master's thesis]. Utrecht University. https://studenttheses.uu.nl/handle/20.500.12932/1443

Toyib, M., Pramesti, G. A., & Herachwati, N. (2024). Enhancing public engagement and science communication through participatory astronomy: insights from the Surabaya Astronomy Club's star party model. *JCOM*, *23*(07). https://doi.org/10.22323/2.23070802

Valdesolo, P., Shtulman, A., & Baron, A. S. (2017). Science Is Awe-Some: The Emotional Antecedents of Science Learning. *Emotion Review*, *9*(3), 215–221. https://doi.org/10.1177/1754073916673212

About the authors

Eleanor S. Armstrong is a Space Research Fellow at the University of Leicester's Institute of Space Research. She is the Early Career Lead at the Leverhulme's Centre for Humanity and Space, and heads the Constellations Lab on Feminism and Outer Space. Her forthcoming book "Exhibiting Outer Space" is under contract with Routledge Museums in Focus.

ea377@leicester.ac.uk

Doris Erhard worked on Project management of "This is (not) Rocket Science!" at the Vienna Museum of Science and Technology (TMW).

rocket@tmw.at

Manuela Gallistl worked on Cultural education on “This is (not) Rocket Science!” at the Vienna Museum of Science and Technology (TMW).

manuela.gallistl@tmw.at

Sarah Rosenbichler worked on Cultural education on “This is (not) Rocket Science!” at the Vienna Museum of Science and Technology (TMW).

Sarah.Rosenbichler@tmw.at

Christian Klösch worked on Scientific project management of “This is (not) Rocket Science!” at the Vienna Museum of Science and Technology (TMW).

christian.kloesch@tmw.at

How to cite

Armstrong, E. S., Erhard, D., Gallistl, M., Rosenbichler, S. and Klösch, C. (2026). ‘It’s (not) rocket science to think with gender: supporting students to develop confidence in talking about gender through outer space outreach activities’. *JCOM* 25(01), N02. https://doi.org/10.22323/155420251226071000.

ISSN 1824-2049. Published by SISSA Medialab. jcom.sissa.it