

# LaleoLab for Engineering Education: Using Game-Based Learning to Challenge Gender Stereotypes and Promote Global Diversity

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**Abstract—** *Gender stereotypes continue to shape educational choices and career trajectories, contributing to persistent underrepresentation of women and other marginalized groups in engineering. LaleoLab, a research-informed board game originally developed in Italy, offers an innovative approach to addressing these challenges through collaborative, game-based learning. By engaging students in critical reflection on gender roles and their influence on STEM pathways, LaleoLab fosters inclusive thinking and challenges normative assumptions about who “belongs” in engineering. This paper reports on the adaptation of LaleoLab within UK higher education, highlighting its potential as a pedagogical intervention for promoting diversity in engineering. Building on a multicultural student workshop funded by a Society & Culture Seed Grant at the University of Warwick, the game was enriched with additional “special cards” featuring diverse role models—including scientists, engineers, and innovators from the Global South—responding to student feedback that representation must extend beyond Eurocentric narratives. These additions aim to broaden students’ understanding of engineering as a global discipline and to inspire aspirations among underrepresented groups. We discuss the educational impact of LaleoLab in fostering critical awareness, intercultural dialogue, and engagement with equity issues in engineering education. Preliminary findings suggest that integrating playful, reflective activities into curricula can complement traditional teaching, supporting efforts to dismantle stereotypes and creating more inclusive learning environments. Future work will explore classroom implementation and evaluate its influence on students’ attitudes toward engineering careers.*

**Keywords—** *Engineering education; gender diversity; game-based learning; inclusive pedagogy; decolonial perspectives.*

## I. INTRODUCTION

It is widely claimed that a workforce with the skills to support innovation, science and technology is essential [1, 2]. Engineers are seen to play a key role in driving economic growth, “leveraging advances in research to develop and deliver new products, services and enterprises” [2]. Diversity is important in ensuring that engineering solutions address the needs of all stakeholders. However, the lack of gender diversity [3] and race and ethnic diversity [4] in Science, Technology, Engineering and Medicine (STEM) present challenges to achieving this.

Despite concerted efforts to increase the Engineering workforce and its diversity, evidence shows that little change has been observed over the years. Research in the United Kingdom using data in aggregate form shows that although the number of students choosing science at secondary

school has increased, there has only been a slight increase in the uptake of science at college, higher education and graduate employment in STEM subjects [5], indicating that policies aimed to increase the STEM workforce have not historically achieved their aims.

Further, men still significantly outnumber women in STEM, with serious implications for gender equality. Gender horizontal segregation contributes to this imbalance, with men remaining over-represented in STEM while women are disproportionately concentrated in areas such as the humanities, education, health, and welfare, which often correspond to fewer career opportunities and lower economic prospects [6].

Women and other marginalized groups continue to be underrepresented in engineering programs and careers [7, 8]. Increased participation is seen in some areas, such as an increase in registrations to a mining engineering course in Chile from 10% of women in 1995 to 40% in 2025 [9]. A similar trend is observed in Ecuador, but the authors note that this was accompanied by an increase in dropout rates and lower pass grades [10]. Hence, it is important to consider the causes for this continued disparity in the profession.

Research shows that stereotypes about gender and intellectual ability, reinforced through language and cultural norms, influence subject choices and career aspirations from an early age. An analysis of more than 145,000 children from 33 countries suggests pro-male stereotypes in computer science, engineering, and physics emerged by age six, alongside increasing pro-male STEM beliefs among girls [11]. This suggests early-forming stereotypes can shape later confidence and interests.

Other factors also influence women’s participation. A systematic literature review of 165 studies published between 2013 and 2023 shows that only a small proportion (17 studies) attributed girls’ lower participation in STEM subjects to individual factors such as interest, self-concept, or attitudes. In contrast, most studies (100) identified environmental influences—including limited opportunities for collaboration, pervasive stereotypes, and insufficient role modelling—as primary contributors. A further 48 studies linked reduced participation to behavioural elements, such as diminished motivation, lower self-efficacy, and limited career planning. [12]. It is important to consider how biases shape perceptions of who belongs in engineering and limit diversity in the profession.

Interventions to change gender stereotypes have shown mixed results. A systematic literature review showed that most studies assumed that increasing participants' awareness of gendered norms would shift attitudes, while peer engagement, multilevel ecological approaches, developing agents of change, modelling through role models, and co-design with target groups also appeared to enhance effectiveness; interventions using direct, multi-session education with mixed-sex cohorts were associated with the most consistent improvements in attitudes and, in a few cases, behaviour [13]. Alternative approaches to achieving long term attitude and behavioural changes in relation to gender diversity in engineering might provide better success in future interventions.

There is growing recognition that innovative pedagogical approaches are needed to complement formal curricula and foster inclusive learning environments. Game-based learning offers one such approach, which has been reported providing meaningful opportunities for practice by emphasising key concepts and segmenting information in ways that support comprehension and retention [14]. Most studies have demonstrated that analogue game-based learning is an effective pedagogical approach that supports learning, cognitive, and psychological outcomes such as memory, problem-solving, creativity, empathy, self-confidence, and wellbeing, while also enhancing engagement, satisfaction, and overall learning processes, partly because board games offer flexible, enjoyable, and low-cost learning opportunities that can reduce barriers and promote both knowledge acquisition and behavioural change [15]. A well-designed board game can provide an interactive and reflective space where students can critically examine social norms and challenge assumptions in a collaborative setting.

LaleoLab, a research-informed board game originally developed in Italy, exemplifies this potential [6]. Designed to raise awareness of gender roles and their influence on educational and professional trajectories, LaleoLab uses playful mechanics to stimulate discussion and critical thinking. We share how we have adapted LaleoLab, translating it from Italian into English for use in UK higher education. We aim to use LaleoLab to promote gender awareness and diversity in engineering education in English-speaking classes. We discuss findings from a student workshop funded by the Society & Culture Seed Grant at the University of Warwick, during which the game was enriched with special cards featuring diverse role models—including scientists, engineers, and innovators from the Global South. We discuss LaleoLab's role in fostering intercultural dialogue and its impact on students' understanding of engineering as a global, inclusive discipline.

## II. LALEOLAB: CONCEPT AND ADAPTATION

LaleoLab is a research-informed board game designed to challenge gender stereotypes and raise awareness of how social norms influence educational choices and career aspirations. Originally developed by Italian researchers in physics, the game was included in the Università degli Studi di Napoli Federico

II's Gender Equality Plan (2022–24) as part of its commitment to promoting equity in STEM education [6].

The game builds on the classic Taboo format: players work in teams to guess a target word without using five taboo words. Each team moves across the board by correctly guessing terms. These taboo terms are deliberately chosen to elicit multiple meanings, including those with gendered connotations, prompting players to think critically about language and stereotypes and requiring them to avoid using the obvious 'taboo' terms typically associated with a concept [6]. This approach deliberately elicits multiple meanings and connotations, encouraging players to communicate creatively without reinforcing gender-biased assumptions. The game fosters reflection on the value of language, its varied meanings and how everyday usage can perpetuate stereotypes. In addition to standard word cards, the game includes four types of special cards introducing stories of prominent figures from scientific, artistic, cultural, social, or political spheres whose gender identities did not conform to dominant social norms, as well as women whose contribution was neglected [6]. The LaleoLab game has been presented at festivals and schools across Italy and it was granted a patent in 2023. Figure 1 shows a section of the game board, each team is represented by a 3D earthworm which was chosen because earthworms are simultaneous hermaphrodites, representing gender equity in the game.



Figure 1: LaleoLab game board and counters

### A. Towards the English Adaptation

The adaptation process followed a participatory design model, engaging students as co-creators to ensure inclusivity and cultural relevance. The staff team brought together expertise in psychology, research methods, data science, game design, Italian studies, and applied linguistics. We recruited undergraduate students as co-creators through two temporary paid positions open to all Warwick university students. Two students, with backgrounds in Chemistry and Global Sustainable Development, were selected by a staff interview panel. Together, we co-created and co-delivered a one-day workshop for students at the University of Warwick titled *Gender Roles and Stereotypes Across Cultures Through a Board Game*. The event, held in June 2025, featured

interdisciplinary speakers and introduced LaleoLab to foster collaborations.

Recognizing that adaptation required more than linguistic translation, we adopted a functional approach guided by Skopos Theory [16]. Hence, the workshop aimed to explore how stereotypes and language shape attitudes across cultures and gather feedback on inclusivity and accessibility of special cards.

We prefer the term adaptation over translation because the process involves preserving stereotypes rather than literal equivalence. In translating the Taboo cards, we used four strategies: literal translation with minor adjustments; substitution of target or taboo words to retain stereotypical associations; splitting cards to capture layered meanings; and removing words without gendered connotations in English.

A substitution example is presented in figure 2, demonstrating our decision to replace the Italian “pantera”, literally translated as panther, with the English word “vixen”. In Italian, *pantera* (“panther”) primarily refers to the animal but also evokes cultural associations such as the character of the Pink Panther (*La pantera rosa*). More relevant for this context, the term can carry a gendered stereotype, referring to a seductive woman who is often portrayed in a negative or objectifying manner. The English term *panther* does not naturally convey this stereotype. To preserve the intended nuance in translation, we replaced it with *vixen*, a word that beyond its literal meaning of a female fox commonly denotes a woman who is perceived as sexually attractive, manipulative, or morally suspect. This retains the negative, gendered connotation present in the Italian original. Only minor adjustments to the associated taboo words were required to align with this shift.

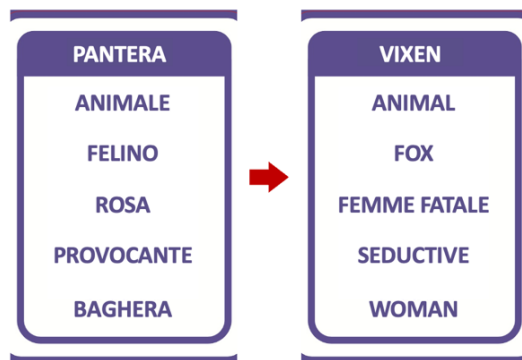


Figure 2: Taboo card translation from the Italian “Pantera” to the English “Vixen”

As for the special cards, each of the four types introduce a character who challenged gender stereotypes through a diverse strategy: image, true or false, fill the blank, or multiple choice. To win the game, participants must collect one of each of these cards by recognising a character or correctly answering a question about their life. Each card includes long text and relevant questions or descriptions. Special cards were initially translated verbatim from the Italian and then summarised in the English version.

## B. The workshop

We invited students at the University of Warwick to attend a workshop called *Gender Roles and Stereotypes Across Cultures Through a Board Game*, offering lunch and a £15 GBP participation token. Its central purpose was to examine students’ understandings of gender stereotypes, the linguistic expressions associated with them, and their influence on gender disparities and inequalities, particularly as these dynamics may vary across cultural contexts. A further aim was to solicit informed perspectives on the responsible translation and cultural adaptation of the LaleoLab game cards from Italian into English, ensuring that the materials remain contextually appropriate and sensitive to diverse audiences. In addition, the workshop sought participant input on refining and extending the set of special cards, including recommendations for new additions and strategies to enhance the accessibility and inclusivity of the role models depicted within the game.

The session opened with a series of icebreaker exercises, including prompt-based conversations and a people bingo activity, designed to facilitate initial interaction. To promote broader engagement beyond existing social groups, the sixteen attendees were subsequently reassigned to different seating arrangements. The structure of the session was:

### Activity 1: Introductions

The facilitation team briefly presented themselves and outlined their respective roles within the project.

### Activity 2: Drawing Exercise

Participants selected cards at random and were allotted two minutes to illustrate the roles depicted. These drawings served as prompts for introductions and a collective discussion on gender representation, cultural framing, and the possibility of role reversals.

### Activity 3: Game Overview

Andreana Pastena, one of the original co-creators of the LaleoLab game, joined remotely via Microsoft Teams to provide an overview of the game’s origins, aims, and development process.

### Activity 4: Taboo Card Task

Participants took part in a table-based competition to identify cards as quickly as possible. This was followed by a structured discussion on the relative difficulty of the task, the effectiveness of the taboo words, and suggestions for improving card design and gameplay.

### Activity 5: Case Study Discussion

The workshop showcased a selection of individuals who challenged gender norms across different cultural contexts (including Rosa Parks, Joan of Arc, David Bowie, Marcel Duchamp, Queen Nzinga Mbande, and Claude Cahun). A Vevox poll was used to prompt reflection on issues of visibility, representation, and cultural recognition.

### Activity 6: Gender Gaps Overview

Participants were presented with key statistics illustrating persistent gender disparities in areas such as education, employment, and pay. This provided contextual grounding for broader conversations about gender roles.

### Activity 7: Keep or Discard Exercise

Participants reviewed the full set of special cards, categorising them based on their familiarity with the individuals represented. The activity prompted discussion about the balance of representation, cultural relevance, and the suitability of each figure for diverse audiences. Groups then considered whether each card should be retained or removed.

### Activity 8: Card Development

Participants proposed new figures who have challenged gender norms and contributed by sketching a draft card or submitting suggestions via Microsoft Forms.

### Activity 9: Translation and Cultural Adaptation Discussion

The session concluded with a discussion about the linguistic and cultural challenges involved in translating the game into English, addressing issues such as cultural nuance, context-specific stereotypes, and the potential for cross-cultural misinterpretation.

The workshop was not framed as a research activity and participant data was not gathered; hence, ethical approval was not sought. Participation was voluntary. Representation choices were guided by student feedback and scholarly frameworks on decolonial pedagogy.

### C. Findings and Discussion

The workshop and adaptation process provided valuable insights into the educational potential of LaleoLab for engineering education. Participant feedback highlighted three key themes:

1. **Inclusivity and Representation:** Students emphasized the importance of featuring role models from the Global South to counter Eurocentric narratives. Figures such as Queen Nzinga Mbande, Tu Youyou, and Mekatilili Wa Menza were suggested to broaden cultural relevance. This aligns with decolonial approaches to curriculum design and supports global perspectives in engineering education. As the game was initially developed in Italy, many of the special card figures were Italian and less recognizable by an international audience.

2. **Accessibility and Engagement:** Recommendations included larger fonts, reduced text density, and splitting special cards into story and question formats. These changes aim to improve readability and comprehension, particularly in competitive gameplay environments.

3. **Impact on Stereotype Awareness:** Activities such as the drawing prompts and Taboo gameplay revealed persistent and cross-cultural gendered assumptions about roles like engineer, nurse, and gamer. While some participants consciously avoided stereotypes, discussions confirmed that the game successfully prompted reflection on language and bias. It must be noted that probably because students who attended the session were aware that it related to gender stereotypes in STEM, we believe participants were more knowledgeable of gender related issues than the general population of students at the university. Overall, student feedback suggests that LaleoLab fosters critical awareness and intercultural dialogue, offering a complementary tool to traditional teaching methods. Its

integration into engineering curricula could enhance student engagement with equity issues and challenge normative assumptions about who belongs in STEM.

### III. FUTURE DIRECTIONS AND CONCLUSION

Future work will focus on three priorities: expanded representation, pilot testing, and impact evaluation. During the workshop, students reported having fun when playing with the taboo cards. However, it was clear from student feedback that incorporating additional role models from underrepresented regions and disciplines, ensuring alignment with decolonial and inclusive pedagogical principles, is important when playing the game with a diverse audience. Hence, our next priority is to integrate the special cards suggested by students and identify additional ones.

Once we have updated the special cards, we plan to pilot test our adaptation. We plan to print the translated version for testing in UK classroom settings. At this stage, the aim is to invite engineering students to play the English version of the game, providing an opportunity to provide further feedback on Taboo card choices and special cards. Rapid testing and adaptation based on feedback from each gameplay will enable iterative revisions that lead to a tested version of the English game.

In the longer term, we plan to test the impact of using the game to challenge gender stereotypes in STEM. A longitudinal study that assesses students' attitudes toward engineering careers and gender equity before and after gameplay will provide the evidence base for the integration of LaleoLab as a pedagogical tool to address gender stereotypes in STEM. Persistent gender gaps in engineering education demand innovative interventions. LaleoLab demonstrates how game-based learning can promote diversity, challenge stereotypes, and foster inclusive thinking. By embedding playful, reflective tools into curricula, educators can create spaces for dialogue and transformation, advancing equity in engineering education globally.

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