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Building shared visions on gender in an Engineering School with Lego® Serious Play®: a pilot study

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Abstract

In the international context, Sustainable Development Goals 5 (gender equality) and 4 (quality education) underscore the imperative of integrating gender equality issues within higher education. In Chile, Ministry of Education Law No. 21.369 promotes the establishment of safe and inclusive environments for all members of higher education academic communities, irrespective of their sex, gender, identity, or sexual orientation. Numerous studies have revealed that non-cognitive and affective factors significantly influence students' academic progress and success. Therefore, it is essential to explore the perceptions and perspectives of students and faculty in the School of Engineering regarding gender, equality, and roles. This pilot research aims to delve into the views held by students and faculty members of a prominent Engineering School in Chile concerning gender-related topics. The specific goals were twofold: a) to provide a reflective perspective on participants' institutional experiences related to gender, equality, and roles within the School of Engineering, and b) to shed light on the challenges and barriers encountered in institutional life. Data was collected using the LEGO® Serious Play® methodology as an innovative and dialogic facilitation method. Twenty students and professors participated. A phenomenological and qualitative analysis was conducted on the workshop recordings to discern emerging perspectives. The results of the initial pilot workshops highlight the significance that gender equality holds for both students and faculty within the realm of university education, as it is seen as the heart of institutional life, a secure space for the development of all individuals. This methodology allowed for the co-construction of knowledge with students and faculties, illuminating the proposal for institutional actions that ensure the effective incorporation of gender equality. It is intended to expand this work by organizing workshops involving students and faculty members from all school campuses.

Keywords: gender, institutional sensitivity, gender stereotypes, Lego Serious Play

Introduction and Framework

Women are underrepresented in science and technology, particularly in leadership positions and specialized, higher-paying roles. The representation of women in these fields is notably low, at most 20% in OECD countries [1]. While participation rates may vary between countries and disciplines, the institutional climate and culture significantly attract, retain, and promote women and girls in STEM. This situation affects how women feel in male-dominated careers due to a low sense of identity within the community and challenges in establishing interpersonal relationships with their peers [2], [3], [4].

Furthermore, feeling a sense of belonging within the institution is essential to understanding and addressing the socio-cognitive needs of students in STEM-related fields. It promotes success and retention [2], [5].

The underrepresentation of women in STEM careers can also increase their vulnerability. This situation can be due to gender stereotypes, negative experiences with teachers or other students, or the hostility encountered in the academic environment, as mentioned in [5], [7].

Beyond the expected responsibilities of higher education institutions, there are deep-seated reasons why incorporating a gender perspective is necessary. It is well-known that various factors are relevant to academic progression and the success of students. In particular, identity and a sense of belonging are widely studied constructs with self-efficacy, especially in STEM disciplines, which often experience high dropout rates [8], [9], [10].

Studies suggest that STEM identity and self-efficacy play a crucial role in shaping career and academic trajectories in STEM. Strong identification with STEM and high self-efficacy can influence career choice and persistence in STEM fields, as individuals who strongly identify with these disciplines tend to be more motivated to pursue careers in these areas and confront challenges with greater confidence [11] [12. Moreover, various studies highlight the importance of belonging in making students feel welcomed by the institution, thereby enhancing self-efficacy [11], [13].

Hence, incorporating a gender perspective in higher education institutions, especially in engineering schools dominated by men, becomes relevant. Higher education institutions should recognize that a gender perspective should be an integral part of the institution. This perspective involves not only considering the concerns and experiences of women and men but also taking specific actions oriented toward achieving gender equality and empowering women [14].

In this regard, on an international level, Sustainable Development Goals (SDGs) 5 (gender equality) and 4 (quality education) reinforce the need to work on incorporating gender equality issues in higher education. In the Chilean context, Ministry of Education Law No. 21.369 aims to promote comprehensive policies to prevent, investigate, sanction, and eliminate sexual harassment, violence, and gender discrimination in higher education to establish safe and inclusive environments for all individuals regardless of their sex, gender, identity, or sexual orientation. Despite some Chilean universities' efforts to promote gender equality, progress is often hindered by the rigidity and resistance of specific university structures.

In this context, the incorporation of a gender perspective at the level of higher education institutions was reaffirmed in 2021 by the National Accreditation Commission through the declaration and update of accreditation criteria and quality standards for higher education accreditation. This declaration has been made by introducing a new criterion related to coexistence management, gender equality, diversity, and inclusion, requiring universities and faculties to promote the comprehensive development of their community, focusing on gender and inclusion, among other aspects [15].

However, various studies demonstrate that universities reflect and perpetuate patriarchal structures and gender inequalities at both structural and cultural levels. This includes gender imbalances and wage gaps, segregation in academic disciplines and activities, the lack of integration of gender perspectives in teaching and research, as well as the presence of biases and discrimination on campuses [16], [17], [18]. Resistance to incorporating a gender perspective into the academic activities of higher education institutions can be partly explained by vague or

weak gender policies concerning what they aim to enforce. On the other hand, it is also due to entrenched practices that still protect male dominance in power relationships. These resistances can be institutional or individual, explicit or implicit, and can take various forms, from denying the need for change to not giving sufficient importance to equality policies [19]. Some authors emphasize the need to distinguish between gender equality (which implies equal resources and opportunities) and gender parity (which focuses solely on numerical representation). In an unequal world, treating everyone equally can perpetuate patterns rather than reduce inequality [17].

At the individual level, we may encounter obstacles related to a lack of awareness or limited awareness of gender and the associated inequalities [20]. In this regard, there are biases against women, for example, in terms of their promotion to leadership positions [17], or in the educational field itself, they face biases related to their capabilities [21]. Limited research also centrally addresses the convergence of gender equality issues and the work-family balance in university settings [18].

Studies conducted in Spain on incorporating gender awareness into university curricula underscore the importance of integrating gender equality into education to address gender inequality and discrimination in professional settings [16], [21]. For example, the work [21] reports a sort of invisibility of gender inequalities in instructional processes. According to the authors, surveyed students have a somewhat unrealistic perception of gender inequalities and power dynamics in the educational environment. This situation could lead to difficulties in the future professional practice of students, as they might not be able to think critically, identify, or recognize various actions that could be discriminatory, for example. The study [22] also finds this dimension predominantly neutral in the Chilean context. Furthermore, when conducting interviews, the students emphasized the need for teachers to be trained in gender-related issues to address specific situations that occur in classes.

On the other hand, the study [21] also showed that the students interviewed perceived institutional sensitivity to gender perspectives as indifferent to low. The authors attributed these findings to the fragility of institutional gender policies and the limited commitment of both the institution and the faculty, which are relevant factors. In this regard, the authors in [22] observed significant differences between the perceptions of men and women surveyed, with the latter perceiving more considerable gender inequalities.

For all these reasons, it is essential to investigate the institutional experiences that a group of individuals may have had concerning these issues. This research aims to explore the opinions of students and faculty members in a prominent engineering faculty in Chile regarding gender-related topics. The objectives are twofold: a) to offer a reflective perspective on participants' institutional experiences related to gender, equality, and roles within the engineering faculty, and b) to illuminate the challenges and barriers encountered in institutional life.

Methodology

Lego Serious Play (LSP) is a method that facilitates idea exploration through storytelling and metaphors. Whether used in different contexts, the core objective of idea exploration remains

constant. The method uses models and metaphors to embody abstract concepts and express formal relationships that might be difficult to comprehend otherwise [23]. LSP is an innovative and dialogical facilitation method based on Piaget's constructivist theory, promoting meaningful learning through the co-construction of knowledge and shared reflection among participants [24].

The LSP methodology is a practical approach to exploring complex and sensitive topics, such as gender equity. It provides a platform for expressing thoughts and feelings that may not emerge in conventional conversations. By using creative and tactile activities like building LEGO models, participants are encouraged to think abstractly and metaphorically, which can uncover a wide range of perspectives. This approach ensures that every participant has an equal opportunity to express themselves, which is crucial in discussions about gender equity. Participants can articulate their experiences and viewpoints on gender equity by constructing models and sharing stories behind them, which fosters empathy and understanding. The collaborative and respectful environment promotes open and honest dialogue, which helps address sensitive topics in a safe space. This is essential for exploring and understanding the complexities of gender equality in higher education institutions.

This study integrated the four core processes of LEGO® Serious Play®: "Posing the Question," "Construction," "Sharing," and "Reflecting" [24]. In the initial stage, the researcher formulates the general question and asks participants to construct stories responding to specific queries. In the second stage, participants create three-dimensional models using LEGO bricks to foster the development of metaphors and new knowledge. The third stage involves participants sharing the meaning of their models and stories, enabling everyone to contribute without external pressures and promoting shared action. In the fourth stage, participants reflect on what they observed in the models and facilitate discussion.

An LSP workshop requires a certified facilitator and a maximum number of participants ranging from 6 to 12 individuals. The facilitator designs the activity based on the set objectives and utilizes a wide variety of LEGO pieces as a means to an end. The overarching purpose of the methodology is to create an engaging and playful environment in which participants can creatively explore and reflect on their existing knowledge of the desired topic, fostering the development of new ideas and perspectives [23].

Twenty individuals were recruited for the development of workshop sessions. They were divided into two groups: one group of seven students and the other of thirteen faculty members from the School of Engineering at one of the university's three campuses. Invitations were sent via email, and attendance at the sessions was voluntary. Before the beginning of each workshop, participants were provided with written information about the research objectives and were asked to sign an informed consent form.

The four core processes were applied to the created tasks during the Lego Serious Play sessions. At the "Sharing" stage, participants shared their stories using metaphors, allowing for the capture of group dynamics and shared experiences. We collected data on the models created during this stage and self-reported perceptions at the reflection point. Each workshop lasted four hours, and we collected data through audio recordings, which were later transcribed. Additionally,

photographs of each "construction" were taken and used in conjunction with the audio recordings to visualize the models beyond the context of the workshop sessions.

The workshops were conducted by two certified facilitators using the LSP methodology. Five construction exercises were designed, four of which were individual, and one was collaborative. Each of the five models associated with each construction exercise was meant to address a specific question. Here is a summary of them:

- Model I (Individual) - "The Tower": This is a warm-up activity to kick off the workshop and ensure active participation, making everyone comfortable with the Lego pieces.
- Model II (Individual) - "The Monument": This exercise triggers reflection on the concepts explored in the research: Engineering, Gender, Equality, and Roles, which the participants randomly select. They are asked to construct a monument representing the concept and tell a story about it.
- Model III (Individual) - "School Committed to Gender Equality": Participants are prompted to think about the School of Engineering and answer the question, "What is the key aspect or factor that you believe should be present in a School committed to Gender Equality?" They are requested to construct a model to narrate a story about that essential aspect.
- Model IV (Individual) - "The Core": Participants are instructed to use a red brick to identify "What is essential in the model?" that is, what is crucial for the concept to exist. This model delves into the core identity of the constructed model.
- Model V (Collaborative) - A shared model is constructed from all the individual "Core" models, representing what participants believe should be present in a School committed to gender equality.

The narratives of the five constructed models were recorded and later transcribed to identify the emerging perspectives that are the focus of this work.

Results

The analysis of this phenomenological and qualitative research work focused on categorizing the results obtained from the narratives participants, including students and professors, provided about the constructed models. This process led to themes and subthemes based on the transcribed data. The analysis centered around two themes discussed by various authors: gender awareness and institutional sensitivity [21], [22].

The narratives were selected from two different models, Model III, and Model V, to represent various aspects of a school committed to gender equality. The narratives of Model III focus on individual perspectives and answer the question, "What is the key aspect or factor that you believe should be present in a school committed to gender equality?" On the other hand, the narrative from Model V represents a shared model that embodies a school committed to gender equality. For a short overview of the constructed models, please refer to the Appendix.

Figure 1 shows three different models that students created, and Figure 2 illustrates three models designed by faculty members. In both cases, the first two models, (a) and (b), are individual

models created by each participant working independently. The third model, (c), is a shared model created by a group of students and faculty members working collaboratively.

Theme 1 – Gender awareness

Gender awareness is about recognizing and accepting gender differences and structures in society. It involves understanding issues like gender stereotypes, inequalities, and power dynamics that affect people based on gender. This awareness is crucial for achieving gender equality, promoting equity, and empowering individuals. It also involves respecting diverse gender identities and advocating for inclusion and respect for all individuals, regardless of gender.
Within this theme, it is possible to differentiate subthemes that emerged in the narratives from students and teachers.
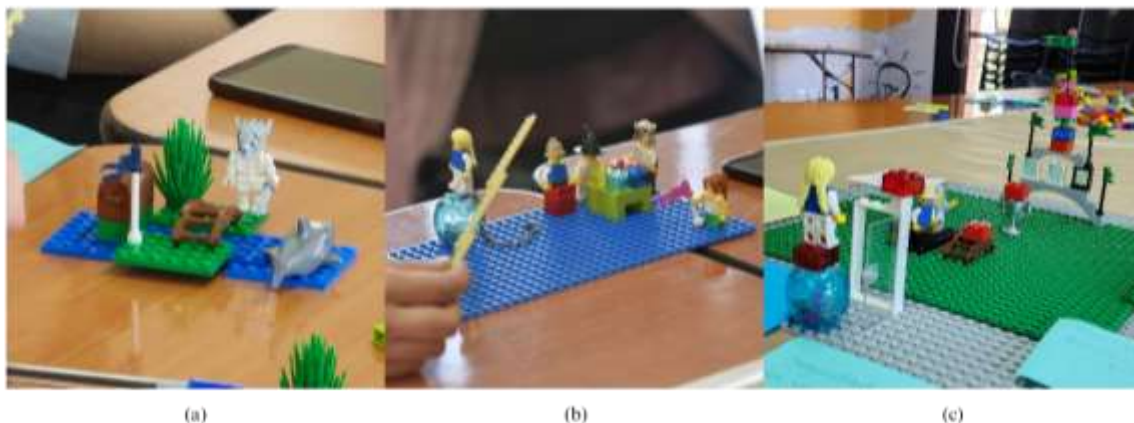

Figure 1. Models created by students - individual models (a) and (b), and a shared model (c)
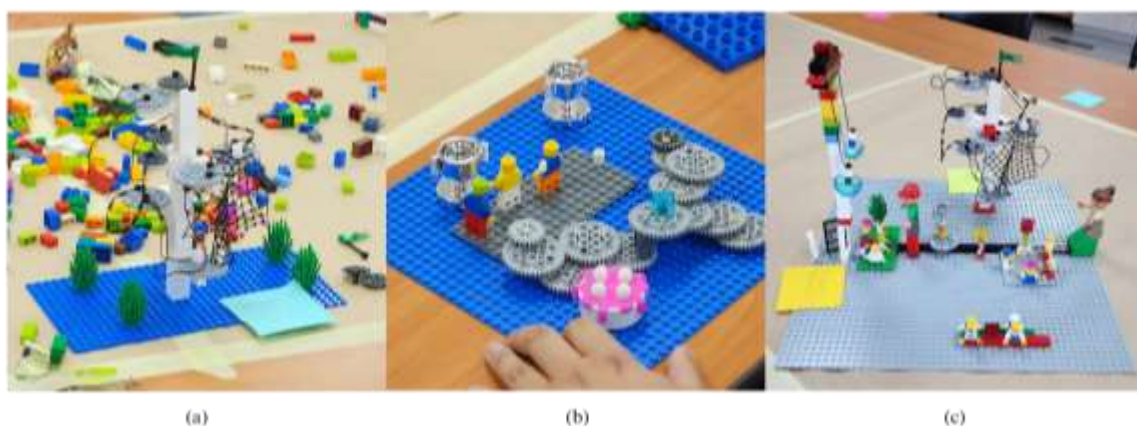

Figure 2. Models created by students - individual models (a) and (b), and a shared model (c)

- *Subtheme: Belonging, inclusion, and diversity*

Students mentioned the feeling of not being part of the university community and how students can represent and feel this. The theme of integration and the importance of everyone feeling part of a community were emphasized.

> *"I also added a chain (to the figure of a girl) because maybe not feeling part of it can influence her because these children are integrated, but perhaps they also have their ties. Moreover, I placed it on this little box [...] which is confidence, but she still cannot perceive or feel it herself." [Student 1]*

> *"[...] because you learn something and a whole new world opens up, and it's spectacular. That feeling is often unattainable for everyone, and that's very unfair. Even though it's there, it remains something that some will never be able to enjoy. [...] From my point of view, for society to value things as they are, that is the goal." [Student 3]*

Faculty members, for their part, referred to similar issues, mentioning that to promote gender equality, it is essential not to discriminate, to provide the same opportunities and tools to everyone regardless of gender, and not to favor one gender over another based on quotas or social expectations.

> *"And there are female doctors, there are also male doctors, so we are all at the same level. There is no difference; there is diversity instead. We are all included in everything. And we are all looking towards the same focus, which is that we are all heading towards the same goal." [Faculty 2]*

> *"[...] I believe that as a School, we can hardly pass on to the faculties and students the commitment to gender equality if we are not capable of not discriminating against the families of our School. [...] For example, suppose we have a family where an employee has two children, and the employee's spouse has a child who is not the employee's child. In that case, they do not include them in the Christmas gifts or outings and are not allowed to include them [...]." [Faculty 5]*

> *"Well, for me, when I consider the topic of gender equality, I consider it, in general, in the access to the university for students, employees, and whoever, so that everyone has the same [...] everyone has the same tools to be able to enter and decide whether they want to enter or not." [Faculty 7]*

- *Subtheme: Presence of Prejudices, Discrimination, and Stereotypes*

Some students recount patterns that describe situations of discrimination within the university context. At the same time, they demonstrate a proactive attitude by engaging as active agents to mitigate situations where gender-related inequalities are evident. There are comments on how stereotypes can affect perception and interaction among individuals.

> *"Yes, it's like the water is where the world or the university is, and there are all the people who would be sharks that might discriminate or criticize a person. So normally the sea is very big, and many people can criticize you. However, one must move forward."* [Student 5]

> *"Here, I discovered that it is a space to make mistakes, have these conversations, and do things. It should also be the case when discussing any topic. We should have zero tolerance for any discrimination or any difference. Within this space, which has many dimensions, this should neither be tolerated nor allowed."* [Student 7]

It is also possible to observe models that relate stereotypes associated with behavior and roles that engineering school students should fulfill and how these affect self-perception.

> *"In the beginning, I perhaps felt that envy, but there is an ugly feeling that men are more than women. [...] I think that the same men in the program, maybe they do it unconsciously, but it's so stereotyped that these careers are for men, that they stand out more than a woman."* [Student 6]

> *"For me, the barrier that exists in this place, in the program, between men and women are the differences that exist unconsciously or consciously, that we are still unable to work on so that these things do not happen. Because they happen… more than one thinks, but not all of us have the confidence to verbalize, face, or communicate it."* [Student 1]

Some teachers also echo the existence of gender stereotypes and discrimination situations:

> *"Because women also handle mathematics, we like mathematics, but the other thing is that when I graduate and leave, I won't have a job because companies do not hire women. So it's a teamwork with engineering firms. So that… they will not tell you don't study electrical engineering, mechanical engineering, or industrial engineering, you will not have a job."* [Faculty 8]

> *"[...] But for example, if we have a family in which the employee has two children, and the spouse of the employee has a child who is not the child of the employee, they are not included in the Christmas gifts, nor the outings, and they are not allowed to include them [...]."* [Faculty 5]

Gender awareness means understanding how gender stereotypes, inequalities, and power dynamics affect individuals. The goal is to achieve gender equality, promote equity, and empower everyone while respecting diverse gender identities. Belonging, inclusion, and diversity are essential for both students and faculty.

Students often feel disconnected and emphasize the need for integration and inclusion. Faculty members stress the importance of non-discrimination and equal opportunities for all genders.

Prejudice, discrimination, and stereotypes are significant concerns. Creating spaces where discrimination is not tolerated is essential. Gender awareness aims to create an inclusive environment where everyone can thrive and feel valued.

Theme 2- Institutional Sensitivity to Gender Perspective

Institutional sensitivity toward gender perspective is crucial for an institution to recognize, understand, and address gender inequalities and the specific needs of women and men in its policies, programs, and practices. It is imperative to consider the different experiences, roles, and gender circumstances that may influence how individuals interact with an institution or are affected by its actions. The accounts of students and teachers highlight significant themes that emphasize the importance of institutional sensitivity.

- *Subtheme: The Value of Communication*

Students reflect on the importance of sharing and opening up to others and how this can promote gender equality. They acknowledge that communication and personal expression are vital for understanding and respecting gender differences.

> *"It's something I can't really explain, but, well, it's about us and our conversation... I see it as a key aspect and factor that needs to be considered in all universities. The ability to share and open up more." [Student 2]*

> *"[...] I had said that crossing this door opens up another world, but if we look at it in the context of the university, I think discussions are important, too. We face prejudices here, too, so being able to share and debate ideas and thoughts is super important. And for the university to take it into account is even more important for the students." [Student 4]*

> *"But it's also about how we do things, I guess. The way we do things seems lost, the willingness to listen. Taking the time to say, 'I'm going to sit with you and I'm all ears, and you're going to be all ears too, because it's a mutual thing, it can't just be one person doing it." [Student 3]*

Communication is crucial for teachers to connect students with opportunities and for leaders to achieve their goals.

> *"[...] I allowed myself to dismantle my model. I had two points: openness and communication. For me, non-negotiable in my approach is good communication. Good communication creates all the necessary paths for openness and achievements." [Faculty 12]*

> *"[...] It needs to work like a network so that... teams function... and there are leaders capable of achieving this goal. Through this network, there's good communication, where students are about to enter a world represented by*

gender equality, and the teams they'll be part of need to have trust. And this is represented by the university's core, the students." [Faculty 3]

"[...] Our focus is our students, and for them, we do all that we do, and we have tools like trust, networking, communication, etc. The team takes these tools, led by a leader, to ensure the team works based on these three elements or pillars so that our students or our focus can one day achieve career success in terms of opportunities." [Faculty 4]

- *Subtheme: The value of a safe space, with trust and opportunities for all*

The students envision an institution free of discrimination and open to discussing gender issues.

"The little plant is for decoration, but it could also help make someone feel confident in what they are doing and in their performance. [...] We must move forward no matter what, that is, normally many things happen to someone, but we have to keep going despite everything." [Student 5]

"In this part, I put a woman. I don't know if you can see her facial expression, but for me, it's very important. She seems upset, but she is determined, so that's why she is carrying a flag, ignoring what's happening in this part and feeling more secure." [Student 1]

"Regarding the building, I think it should always have its doors open for both people who want to enter and those who want to leave, but it must be a very secure space in itself. It pains me to hear [...] that they can feel insecurities, that they can feel that men are better than women. This is something that should not exist, not even that thought should exist." [Student 7]

Additionally, both students and teachers highlight the importance of including all genders in university activities, equitable representation, and appreciation of diversity, with teachers emphasizing the opportunities associated with professional training.

"The inclusion of people in activities such as olympiads, sports, or any activity related to the university. That's why I chose a skull, because it has no gender, and the mask with the sword are the tools a person has to achieve this, which are all the opportunities. [...] This is the goal, and the chest is the opportunity, so together they make up all the opportunities that can be achieved." [Student 3]

"Well, what I tried to do here, and I think I achieved something, was a scale [...] it should be equal in terms of opportunities, regardless of whether they are men or women, rather it should be even in that sense and look for opportunities, regardless of gender." [Teacher 4]

The participants discussed the importance of institutions providing equal opportunities for gender equality.

- *Subtheme: The value of shared goals and networks*

Emphasis is placed on the importance of the faculty promoting a sense of connection with the institution and peers for all genders, recognizing the dynamics of exclusion that may significantly affect women in specific spaces traditionally dominated by men. Particularly, students propose this as an institutional goal.

> *"I created a path because it's a path we all have to walk together, and it has to be a new goal. This represents a new goal that we have to set together. Although there is an initiative from a specific group of people interested in improving our environment, the goal for everyone is not the same, and a company or any group of people has to work with a common objective" [Student 3].*

> *"I feel that these careers are seen as being for men. Here I made a man with an angry face, a woman, this is the goal [...] In the beginning, I maybe felt that envy, but there is an ugly feeling that men are more than women. I'm not sure if it's in the career, but that's what I feel. We should work hard because we can all reach the goal". [Student 6]*

In the same sense, the teachers express themselves in different terms. They suggest that a faculty committed to gender equality should promote networking and the creation of networks among all genders, offering equal access to support groups and collaborative opportunities. They also highlight integration and working in diverse teams.

> *"There is no difference; rather, there is diversity. We are all included in everything. And we are all looking towards the same focus, which would be that we are all looking towards the same path, which is achieving a goal." [Faculty 2]*

> *"It all comes down to a gear that aims to be perfect, and each gear, at its core, is each person who has to fulfill a role, regardless of gender; everyone has duties and responsibilities so that this gear works and the objectives we are working on today are achieved." [Faculty 9]*

> *"I wanted to express the importance of networking and forming equal networks. So, women and everyone should have equal access to networks and support groups. Here in Chile, unlike other countries, this is very poor in that sense." [Faculty 10]*

Institutional sensitivity towards gender perspective is of paramount importance in any educational institution. This approach not only encompasses understanding and addressing gender inequalities but also emphasizes the significance of communication, creating safe spaces,

and promoting shared goals and networks. Both students and teachers deem it necessary to integrate all genders in university activities, ensuring equitable representation and appreciating diversity. Furthermore, creating accessible support networks and collaborative opportunities for all genders is crucial in fostering an environment of equality and respect. Essentially, institutional sensitivity towards gender perspective is not just an institutional goal but an ongoing commitment to inclusion, equity, and collective success in the educational realm.

Co-construction of knowledge and shared reflection

During the last segment of the workshop, the participants were tasked with creating a shared model that represents what should be present in a faculty committed to gender equality. In order to accomplish this goal, the participants interacted with each other, generating various narratives about the constructed model, which demonstrated the knowledge they had constructed throughout the workshop.

The students discussed various concepts related to personal and professional development in an educational environment, specifically in an engineering school, while building a shared model. Figure 3 displays the most commonly used words in the students' narrative. The main topics were feeling secure and being in a safe space, which is essential for learning and growth. They emphasized the significance of communication and transparency in creating an environment where individuals can communicate freely.

Figure 3. Shared Model - Students - Word Cloud

Confidence was another significant theme, with students stressing its importance in starting something new and the various ways to gain it. Self-confidence was seen as a crucial element of empowerment, represented by a 'cup' symbolizing knowledge and self-confidence. Knowledge and emotional intelligence were also seen as essential for personal development and the learning process.

The students highlighted inclusion and having a support network as crucial elements for gaining confidence and achieving success. They discussed crossing an "inclusion bridge" to feel included and safe. The discussion also touched upon integrating personal development throughout the educational experience, including equipping oneself with new tools and skills.

As presented in Figure 4, faculty members emphasize the importance of focusing on students as the main reason for all educational and developmental activities. They highlight several key themes, stressing the need to provide balanced access to education. This approach goes beyond ensuring gender equality; it also focuses on recognizing individual value and professionalism. There is a significant discussion on the need to acknowledge diverse family backgrounds and treat students as part of a broader educational "family."

Figure 4. Shared Model – Faculty members - Word Cloud

Confidence is identified as a critical starting point for leadership, fostering opportunities within work teams. The role of effective communication and networking is also underscored, as these skills are crucial for maintaining a balanced environment within any organization. The

instructors mainly focus on preparing students, especially in STEAM fields, for participation in a gender-equitable job market.

The necessity of a balanced admission system that fairly represents academic instructors and families is discussed. Instructors view individual commitment and trust as the organization's backbone for achieving educational and occupational goals. Efforts to improve opportunities for women and to balance job opportunities, both within and outside the university, align with the goals of equality and diversity in the workplace.

The workshop highlighted the necessity of collaborative endeavors to advance gender parity in engineering schools. Principal themes, such as self-assurance, effective communication, emotional intelligence, and support systems, surfaced as pivotal constituents of success. The faculty's emphasis on a student-centered institution, impartial accessibility, and readiness for a gender-equitable job market evinces institutional accountability in cultivating an equitable learning ambiance.

Discussion of Results

The outcomes of the initial pilot workshop for students and faculty highlight the significance of gender equality in the realm of university education, at the heart of institutional life, conceived as a safe space for the development of all individuals. The models created by participants, both teachers and students, helped us understand their knowledge, perspectives, and personal experiences on the topic.

When analyzing the individual models constructed, a fundamental similarity between both groups is the value they place on open communication and inclusive dialogue as tools to promote equity and mutual understanding. Both students and teachers recognize the importance of sharing experiences and opinions and the need to create spaces where all voices can be heard. However, they also acknowledge the existence of biases, discrimination, and gender-independent limitations. In their view, the institution should ensure safe and trustworthy spaces that enable inclusion and equality, concepts repeatedly mentioned in the narratives and considered relevant in a School committed to gender equality. Such safe spaces would facilitate integration, identification, and, thereby, a sense of belonging within the institution.

There are notable differences in how each group approaches these gender perspective-related issues. Students focus more on personal experience and social dynamics within the university. For example, they discuss how certain practices can make some groups feel excluded. A central theme is the sense of belonging and integration into the university community, emphasizing how certain groups, particularly women, can feel excluded or marginalized. For instance, a student discussed a model representing a table around which only men gathered, symbolizing gender barriers and lack of inclusion. Another aspect students highlight is the need for a trusting and supportive environment among students and faculty staff. The lack of confidence inhibiting personal and professional development, especially in women, was addressed, highlighting the importance of creating safe and welcoming spaces for all genders. This affects how women feel in male-dominated careers due to low identity perception within the community and difficulty establishing interpersonal relationships with peers. Belonging and inclusion become fundamental

elements in understanding and addressing the socio-cognitive needs of STEM students, as they are crucial to promoting student success and retention [2], [3], [4], [5].

On the other hand, faculty tend to focus on more structural and organizational aspects, such as equality in representation and achieving institutional goals, with equitable representation of men and women in various roles and academic levels. They emphasize that gender equality is not just about the balanced numerical presence of both genders but also about diversity and inclusion in all school activities and goals. These findings are in line with several investigations that highlight the presence of gender imbalances and segregation in academic disciplines and activities [16], [17], [18].

Another significant difference is how each group perceives equality of opportunities. Students emphasize the importance of inclusion in extracurricular and academic activities, highlighting gender-based segregation as a barrier, a way to reinforce stereotypes, and a way to limit their student experiences. In contrast, faculty focus on equality regarding access to education and career opportunities, underscoring the importance of equity in representation in different academic and professional roles.

The relationship between students and their connection to the community and future employers would significantly improve the employability of men and women belonging to this faculty. However, according to some faculty members, women's entry into engineering careers is limited by the belief that women's employability in such male-dominated fields is low. Therefore, it is crucial to generate a sense of security for female students when entering these careers and for the university to maintain internal communication with the corporate world and create alliances and opportunities before students enter the workforce.

In summary, while there are coincidences in the concerns of teachers and students, such as the emphasis on a safe environment and the importance of communication, their perspectives differ in focus. Faculty view these issues in the context of professional development and organizational effectiveness, while students focus more on personal growth and the immediate educational environment. This is evidenced in the shared models constructed by each group. The difference in focus between faculty and students can be attributed to their different roles and objectives within the educational ecosystem. As educators and facilitators, faculties are responsible for creating an environment conducive to learning, ensuring equal opportunities, and preparing students for professional success. Their perspective is shaped by a broader vision of the educational system and its role in society, including preparing students for the job market and instilling professional skills. On the other hand, students focus primarily on their personal growth, learning, and immediate academic challenges. Their perspective is more about navigating the educational process, acquiring knowledge, and developing personally and emotionally within the confines of the institution.

Together, these issues demonstrate a comprehensive understanding of the complexities of engineering education, underscoring the importance of balanced access, trust, effective communication, and a focus on student and professional development within an environment that values equity and diversity.

Conclusions and Future Directions

The pilot study at an engineering school using LEGO® Serious Play® methodology highlights several key insights into gender equality in academia. It underscores the critical importance of acknowledging and embracing gender diversity and inclusion, not just in numbers but as part of the institution's culture. Open and inclusive communication has emerged as essential in promoting equality and understanding. There is a notable divergence between faculty and students' focus regarding gender issues, with faculty concentrating on structural aspects and students on personal experiences and social dynamics. This calls for initiatives addressing both institutional changes and individual experiences.

The study also points to the significant role of institutional policies necessary to foster an equitable environment, emphasizing the need for policies that ensure equal opportunities and combat discrimination. Education and professional development are vital in empowering individuals for success in a gender-diverse workforce. A supportive and committed environment is crucial for all students' personal and professional growth, especially those from minority groups. Finally, these findings highlight the complexities of integrating gender equality into engineering education and the need for a balanced approach encompassing structural changes and individual growth.

Concerning future directions, this methodology facilitated the co-construction of knowledge, illuminating proposals for institutional actions that ensure the effective incorporation of gender equality. Implementing these workshops with more students and faculty from all campuses of the School of Engineering is promising. This approach allows for the inclusion of more voices and realities, guiding actions at an institutional level.

This is the beginning of a continuous transformation towards a more inclusive higher education, where each voice is heard and every individual feels valued, thus contributing to the holistic growth of our institution and its members.

Acknowledgments

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Appendix

Table 1: Models constructed by students.

	Model name	Core	Representation	Gender	Age
Student 1	Belonging	Self-assurance	A miniature figure representing a girl on a transparent sphere with shiny objects inside, signifying confidence	Women	23
Student 2	Communication power	Confidence	Goblet piece, symbolizing power	Men	21
Student 3	Reconceptualization of the important	Knowledge	Various pieces that represent the brain	Women	23

Student 4	Trust space	Confidence; Transparency	The door piece is a central aspect of the model, symbolizing transparency and trust.	Women	21
Student 5	Inclusion of everyone in activities	Inclusion, progress towards equality	Pieces building a bridge to illustrate inclusion	Men	24
Student 6	Empathy and respect	Confidence	Pieces representing teachers/moderators, signifying trust	Women	20
Student 7	Safe space	Communication in a safe space	A castle is a representation of a safe space	Men	34

Table : Models constructed by faculty members.

	Model name	Core	Representation	Gender
Faculty 1	Openness and Communication	Integration	Represented by a monkey piece (animal) as the teacher must fulfill many roles.	Female
Faculty 2	Diversity	Ideas and initiatives of the school	Represented by a leader figure resembling a superhero for the teacher.	Female
Faculty 3	Ideas	Confidence	Balance made of small pieces and different colors.	Male
Faculty 4	Opportunities	Community engagement	Pieces of animals represent the family as an essential part of those who are part of the university, including faculty and staff members.	Female
Faculty 5	No discrimination	Equal access to opportunities	Pieces that build a bridge to illustrate inclusion.	Male
Faculty 6	The value of people	The value of people	A platform of pieces representing the value and role we occupy and the construction.	Female

Faculty 7	Equality and access to opportunities	The family	Balance and equilibrium, characterization of figures with accessories alluding to roles.	Female
Faculty 8	Integration into the labor market	Equality and balance	Balance is made of small pieces and different colors.	Male
Faculty 9	Good functioning and synchrony	Leadership	With a mini figure representing the project's champion for everything to work in a coordinated and effective way.	Male
Faculty 10	Networking	Importance of people and roles	For the entire system to work, it is represented by gears, and it also represents links and connections with other smaller pieces.	Male
Faculty 11	Mathematics associated with the sum of efforts	Increase in the diversity of female gender incorporated into engineering	Represented by various mini figures of women and men and the transition in opening gender profiles and possibilities that did not exist before.	Female
Faculty 12	Openness and Communication	Good communication	Mini figures represent bridges and paths to establish an optimal communication and open ways for it.	Male
Faculty 13	Good leader	Champion of Leadership	It represents a leader with a mini figure and the elements they must have to keep their team motivated.	Male