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Article

STEAM Girls Club: A strategy to reduce the gender gap and develop soft skills

Club de Niñas STEAM: Una estrategia para reducir la brecha de género y generar habilidades blandas

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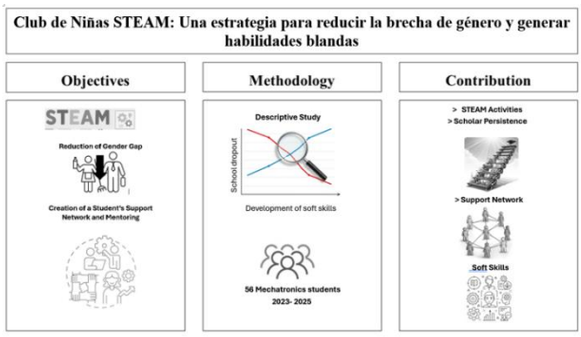
Abstract

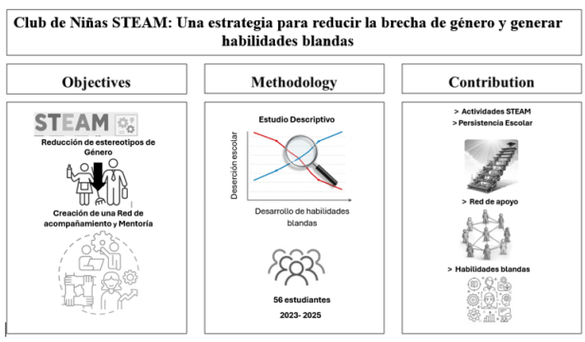
The objective of this research is to present the STEAM Girls Club as a strategy that helps reduce the gender gap by decreasing dropout rates among its members and by developing soft skills through the educational approaches used within the club, such as service-learning and mentoring. The study, which is mixed-method, longitudinal, and descriptive, analyzes dropout rates and the development of soft skills among the club members over time. The population consisted of 56 women enrolled in the Mechatronics program. The results show a lower dropout rate among members compared to that reported by the generational cohort. Furthermore, there was evidence of strengthened skills such as leadership, empathy, teamwork, effective and assertive communication, listening ability, and more. The findings suggest that active participation in the club contributes to comprehensive development and academic success.



Service-learning, Gender gap, Mentoring

Resumen

El objetivo de esta investigación es presentar al club de niñas STEAM como una estrategia que permite reducir la brecha de género, al disminuir la deserción de sus integrantes y al generar habilidades blandas a través de los enfoques educativos que operan dentro del club, como lo son el aprendizaje servicio y las mentorías. El estudio, de tipo mixto, longitudinal y descriptivo, analiza la deserción y el desarrollo de habilidades blandas en las integrantes del club a lo largo del tiempo. La población estuvo compuesta por 56 mujeres que cursaron la carrera de Mecatrónica. Los resultados muestran una menor deserción en las integrantes, comparado con la reportada por cohorte generacional. Asimismo, se evidenció el fortalecimiento de habilidades como liderazgo, empatía, trabajo en equipo, comunicación efectiva y asertiva, capacidad de escucha, etc. Los hallazgos sugieren que la participación activa en el club contribuye a la formación integral y al éxito académico.



Aprendizaje-servicio, Brecha de género, Mentorías

Area: Advocacy and attention to national problems

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Introduction

Our current job market demands outstanding professionals in science, technology, engineering, art, and mathematics [STEAM]. For this reason, jobs related to these fields are currently among the highest paid. [CIMAD & Movimiento STEM, 2020].

Unfortunately, in Mexico, women have been underrepresented in STEAM fields, with men being the ones who stand out the most. Only 30% of women pursue a STEM degree, and of those, just 8% study engineering, manufacturing, and construction [García & Torres, 2022]. Only 3% of Nobel Prizes in sciences have been awarded to women [Bello, 2020]. This disparity or inequity between men and women is known as the gender gap and is largely responsible for the wage gap [Saravia & Cifuentes, 2024].

This issue is so important that one of the Sustainable Development Goals is precisely to overcome the various manifestations of gender gaps, since equity is the foundation for a prosperous and sustainable world [Bello, 2020].

One way to help close the educational gender gap would be to reduce dropout rates among women in STEAM fields.

Miller & Croft [2022] found that one way to decrease dropout rates was by involving students in university center activities, as this creates a sense of belonging. Additionally, they noticed that these activities promoted meaningful relationships between students in lower and upper-level courses.

According to García-Bullé [2022], mentoring can contribute to the retention of female STEAM students. She even asserts that mentoring helps realize the potential of a STEAM student not only in her field of study but also in her empowerment, resilience, leadership, self-confidence, and self-esteem, especially when mentors are peers or similar.

Therefore, one of the strategies aimed at contributing both to gender equity within our community and to the development of soft skills among female university students stems from the STEAM Girls Club project. This educational initiative was launched at the beginning of 2023 in the Mechatronics program at the Technological University [UT] of Altamira.

Through mentoring and various activities inside and outside the university, it seeks to foster the interest and active participation of girls and young women in STEAM fields. This initiative is also based on the service-learning [S-L] approach, which combines academic learning with social engagement, allowing students to apply their knowledge in real contexts and develop skills such as empathy, leadership, and critical thinking.

This pedagogical approach supports the development of 21st-century skills, both technical and socio-emotional, and strengthens the social commitment of university students, making the STEAM Girls Club a replicable model of educational innovation with social impact and a gender perspective. The club aligns with the principles of equity, inclusion, and educational transformation, generating a positive impact on both the girls benefiting and the young mentors.

Therefore, this article will focus on explaining the use of the STEAM Girls Club as a strategy to reduce dropout rates among women in STEAM professions while also helping to develop soft skills in female university students.

First, the topic of dropout rates among women in STEAM will be detailed; next, service-learning [S-L] will be discussed; then, mentoring will be addressed; and finally, the STEAM Girls Club will be explained in detail.

1. Dropout of Women in STEAM

One of the problems many students face is academic dropout. Within STEAM fields, the dropout of women is an even more significant issue due to the low number of women who choose to study these careers.

Approximately 47% of students do not complete their studies, and in the most disadvantaged socioeconomic sectors, this percentage increases to 79.3% [Medrano & Flores, 2017].

The dropout rate of women in STEM education is also particularly high. Women disproportionately leave STEM disciplines during their studies and professional careers. This gender gap in science widens during the transitions from high school to higher education [CIMAD & Movimiento STEM, 2020].

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Once women enter STEM programs, they are more likely to drop out and not return. The percentage of women entering these fields is much lower than that of men, and many women leave during their training, resulting in fewer women graduating in these professions. Specifically, science requires commitment, time, and effort due to the rapid and constant changes in this field.

Many adult women, who have family responsibilities [such as caregiving], may distance themselves from these areas due to a lack of confidence in meeting these expectations. This situation affects professional development and is reflected in the scarcity of women in higher-level positions, partly because there are fewer women candidates for those jobs [Quispe, 2023].

Regarding the dropout of female students in the Mechatronics program at UT Altamira, the rates were 38.4% for the 2018-2022 cohort, 20.5% for 2019-2023, 42.8% for 2020-2024, and 50% for 2021-2025. Therefore, it can be concluded that the dropout rate among women has increased worryingly.

One of the reasons found is that many women who choose to study a STEAM career may drop out due to demotivation caused by impostor syndrome, which is a form of self-sabotage—a fear of failure experienced by some women whose main belief is insufficiency despite success or feeling less competent than they should be [Quiroz et al., 2023].

It has also been found that many women studying in predominantly male groups, which is common in STEAM professions, are easy targets for aggression or sexual harassment. This can lead female STEAM students to drop out in order to escape such harassment and violence [Olarte 2018].

2. Service-Learning

According to the Secretaría de Educación Pública [2024], the New Mexican School promotes service-learning as an educational practice that fosters relationships between schools and the community.

Service-learning is a teaching tool that combines the acquisition of academic competencies with the provision of a meaningful, solidarity-based service to society. Its goal is to educate students by bringing them closer to real-world situations through socio-educational projects that help foster learning in values. It is based on reflection about the social environment, its functioning dynamics, and social problems and inequalities. It requires collaboration between educational institutions and community service organizations [Salcedo, 2019].

Service-learning differs from general community service in that it aims to integrate curricular content learning [Secretaría de Educación Pública, 2022]. It must also meet three essential conditions: the student must be the protagonist of the project, supported by their academic advisor; the student must acquire curricular knowledge while applying it in a spirit of solidarity; and all actions must address real needs in society [Salcedo, 2019].

One of the most recognized researchers in service-learning is Andrew Furco, who confirms that through service-learning projects, students improve their academic learning and classroom relationships [Martínez et al., 2024].

According to Medina [2023], service-learning has a personal impact on students. By overcoming challenges and experiencing a sense of achievement, they gain self-confidence and discover their strengths. They also learn to work as a team and develop leadership skills. Research has demonstrated the pedagogical potential of this practical philosophy or methodology to influence: academic development, civic development, vocational and professional development, ethical and moral development, and personal and social development. It also promotes student-teacher participation as a strategy for school improvement and strengthens collaborative relationships between schools and other community institutions [Mayor, 2018].

Along this path, students discover the true meaning of learning. It is not only about acquiring academic knowledge but about cultivating socio-emotional skills that will accompany them throughout their lives. They learn to be compassionate leaders, to develop effective communication skills, and to work as a team toward a common goal [Medina, 2023].

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Salcedo [2019] found that service-learning acts as a factor of academic resilience, helping to prevent school dropout by providing numerous psychological benefits. He even emphasizes that the teacher becomes a "resilience tutor," an empathetic support figure who offers students a space where they can feel useful in the face of challenging situations.

Ultimately, service-learning not only raises awareness but also fosters student commitment to the Sustainable Development Goals, while they acquire knowledge and skills, and strengthen attitudes and values [Martínez et al., 2024].

3. Mentoring

Mentoring is a process of guidance and support from a more experienced person, known as the mentor, toward another person seeking to gain that experience, known as the mentee [Gutiérrez, 2020].

Women's mentoring has proven to be a highly effective method, especially for young children, who naturally tend to imitate their parents [Reyes & Novoa, 2015; Macías et al., 2021].

Mentoring programs for STEAM students aim to: promote gender equality; increase opportunities for women in STEAM fields; provide support, guidance, and role models; raise awareness and encourage reflection on gender stereotypes and biases; and invite women to become part of a support network [Duoc UC, 2024].

The positive influence of role models on women at the beginning of their professional careers has long been recognized. Young women who have role models tend to have higher self-esteem, greater confidence in their abilities, and increased satisfaction with their chosen profession. Therefore, mentoring is a valuable tool for fostering scientific identity and career development among female students [Quiroz et al., 2023].

Women's mentoring has the significant advantage of not only motivating women to enter science and technology fields but also promoting their retention in these careers.

Through mentoring—and by establishing a relationship of support and learning—life experiences and knowledge are shared, inspiring other women to follow in their footsteps and grow within these fields [García-Bullé, 2022].

Although it may be assumed that the best mentors are experienced professionals, research shows that the benefits of mentoring are often greater when mentors are peers or near-peers, as long as they receive prior training. For this reason, mentoring is also used at various academic stages of students' education [García-Bullé, 2022; Quiroz et al., 2023].

In our country, a more recent mentoring program has been implemented with the support of the British Council. Since 2021, the program has funded training for women from the National Council of Humanities, Sciences, and Technologies to serve as mentors. The outcomes and progress of this program have significantly benefited both the mentors and the female students who received mentorship [Quiroz et al., 2023].

Among the additional benefits observed for mentors, a study found that 82% reported mentoring had a positive impact on their performance in terms of learning and skill development. Another benefit was the expansion of their professional network. It also helped them become more aware of their behavior and communication, speak more assertively, show greater empathy, provide better feedback, improve emotional intelligence, become more patient and humble, adapt to others' needs, improve their listening skills, and more [Escuela de Mentoring & Red GEM España, 2023].

4. STEAM Girls Club

The STEAM Girls Club is an educational initiative led by around 50 female students and six higher education teachers that aims to reduce gender stereotypes in the fields of science, technology, engineering, arts, and mathematics by encouraging scientific vocations among elementary school girls through mentorship by university students.

The project is primarily aimed at girls between the ages of 6 and 12 from elementary schools, as well as female engineering students, who actively participate as mentors and facilitators of scientific workshops.

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The club is implemented through hands-on activities, playful workshops, school visits, participation in science outreach events, technical training, and socio-emotional development. Activities take place both within the university and in local elementary schools.

University students design materials and carry out activities through mentorships, allowing young girls to identify with their mentors, break down gender stereotypes, and engage with science in an accessible and fun way. At the same time, this strengthens the university students' technical, communication, and leadership skills.

In fact, a study was conducted presenting the results of a series of electronics workshops carried out in three public elementary schools as part of the STEAM Girls Club. The results were: knowledge about STEM careers increased by 41.3%, gender stereotypes were modified by 8.3%, preference for STEM careers rose by an average of 36.5%, and the mentoring method was effective in 43.75% of the cases [González et al., 2024]

This project takes place in a context where female representation in science and technology fields remains low, and it aims to help close this gap through service learning, peer mentoring, and the creation of support networks. Furthermore, it promotes a replicable and sustainable model that connects curricular content with socially impactful actions, creating a more equitable, inclusive, and transformative educational community.

The initiative promotes interdisciplinary integration through the design and implementation of scientific workshops, demonstrations, and educational activities in which university students explain concepts in physics, electronics, programming, chemistry, and clean energy to elementary school girls. This work involves translating technical knowledge into accessible language, fostering in university students the ability to communicate complex ideas, plan educational sessions, solve problems in real time, and adapt to diverse educational contexts.

From a cross-disciplinary perspective, the club also enables collaboration with other key disciplines for the comprehensive development of the students.

This initiative also aligns with service-learning, by linking curricular content with socially impactful actions, which strengthens both the students' sense of belonging and their ethical responsibility to their community. In this way, the club becomes a living extension of the classroom, where technical skills are consolidated and key 21st-century competencies are developed—such as leadership, teamwork, innovation, systems thinking, and social commitment.

Among the club's activities, it is worth noting that from January 2023 to August 2025, a total of 18 activities have been carried out: four training sessions, seven school visits, and seven participations in events such as "Knowledge Detectives", "Children's Week", the "Second National STEM Girls Meeting", among others.

In conclusion, the STEAM Girls Club functions as a space for curricular integration across academic terms, involving students from various academic levels who work together, collaborate, and learn from one another—fostering a horizontal, intergenerational, and highly formative community of practice.

Methodology

This study is descriptive in nature, as it examines two main variables within a specific population: school dropout and soft skills development. School dropout is defined as the permanent or temporary abandonment of studies by a student before completing the corresponding curricular program. It was measured through the review of attendance records and academic performance in course evaluations. Soft skills development is understood as the improvement of non-technical competencies such as communication, teamwork, leadership, and critical thinking, which were assessed through qualitative observation during STEAM Girls Club activities and through records of participation in conferences, events, training sessions, and workshops.

The study follows a mixed-methods approach, integrating both quantitative data [attendance percentages, grades] and qualitative data [observations and narrative records]. It is also longitudinal, as it analyzes the population over a period from January 2023 to August 2025.

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The population consists of 56 women who enrolled in the Mechatronics TSU [University Technical Degree] program from January to April 2023 and continued their engineering studies through to May–August 2025, while also being active members of the STEAM Girls Club. Their ages ranged from 17 to 22 years.

The combination of quantitative and qualitative criteria allows for a more comprehensive assessment: attendance records and academic grades provide objective and comparable data, while the observation and documentation of activities offer contextual insights into the quality and type of skills developed.

Results

Quantitative Results on Dropout Rates

In the results obtained regarding dropout, it was observed that the dropout rate among the STEAM Girls Club population from 2023 to August 2025 was five students, which corresponds to 8.93%. See Figure 1.

Box 1

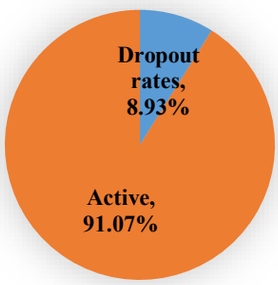

Figure 1
STEAM Club Dropout Rate
Source: Author´s own work

Quantitative Results on Participation

The average number of events in which students participated was 2.7 events [15.37%]. A total of 26 students [46.42%] participated in more events than the average. The most active student, who remains involved in the club, has participated in nine activities [50%]. The second most active student has taken part in seven activities [38.88%]. In total, 91% of the students have participated at least once in club activities.

Regarding the participation of the students who eventually dropped out of the club, it is worth mentioning that one student never participated [0%], another student took part in only one activity [5.5%], one attended two [11.11%], another supported three [16.66%], and the remaining student participated in four activities [22.22%]. See Figure 2.

Box 2

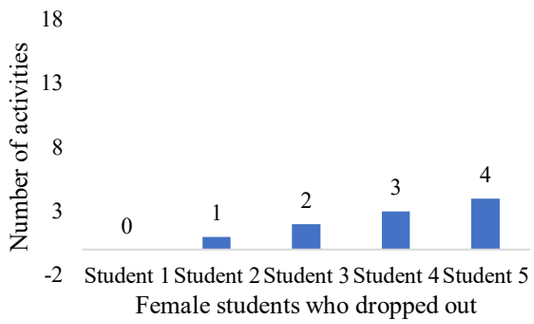

Figure 2
Participations of female students who dropped out from the activities in the club
Source: Author´s own work

Qualitative Results – Soft Skills

Regarding the qualitative results, it was observed that the students developed creativity and empathy through the design of educational materials for training workshops aimed both at elementary school girls and at peers from earlier academic terms.

They also improved their communication skills, active listening, patience, and empathy, as they effectively interacted with approximately 578 younger children during school visits, mentorship sessions, workshops, and other events.

Leadership and empowerment were observed in eleven students [19.29%], who led two induction and training sessions for new members of the club—one in January 2025 and another in February of the same year.

Problem-solving skills were also demonstrated, as students managed to repair and troubleshoot workshop materials in at least three separate instances.

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Teamwork was evident in all 18 events, particularly in one called the *Science Circus*, where students collaborated to write scripts and create stage design.

Finally, the students demonstrated a strong commitment to sustainable development and community engagement, as all their work was carried out on a voluntary basis.

Conclusions

The authors' claims can be verified. The STEAM Girls Club, by implementing the Service-Learning [S-L] approach and mentorships, helps significantly reduce dropout rates [Salcedo, 2019; Miller & Croft, 2022 and García-Bullé, 2022]. This is especially evident when comparing the dropout rate within the club [8.77%] to that of the most recent cohort [50%]. However, further studies are needed to determine whether the STEAM Girls Club has a long-term impact on each generation's dropout rate.

An analysis of student participation shows that 60% of the students who dropped out participated less than average in club events. This could suggest that the club's impact on reducing dropout rates increases with greater participation in its activities.

Regarding soft skills, the authors' observations on the Service-Learning approach are confirmed by the fact that the students worked in teams and developed leadership, effective communication, and a commitment to sustainable development [Mayor, 2018; Medina, 2023 y Martínez et al., 2024].

Regarding the mentorships, it is important to note that they developed both within and outside the club, as many new mentors [at the technical level] looked up to the club members from higher semesters [engineering level] as role models. This reflects what the authors have stated — that mentorships help expand students' support networks, while also fostering friendships among them. It was also evident that the mentorships helped them become more aware of their language, communicate assertively, and develop patience and empathy. [Escuela de Mentoring & Red GEM España, 2023].

It is recommended to expand this study using a standardized instrument or survey that allows for a deeper analysis of the soft skills developed by students through their participation in the STEAM Girls Club. Additionally, it would be valuable to compare groups of women who are members of the club with those who are not, or with students from other academic programs. It is also suggested to continue monitoring the gender gap and dropout rates to assess the club's long-term impact.

Declarations

Conflict of interest

The authors declare no interest conflict. They have no known competing financial interests or personal relationships that could have appeared to influence the article reported in this article.

Authors contribution

González-Barrón, María Teresa: Contributed to the Project idea, research method, investigation, project administration, writing-and editing original draft, data analysis.

Alvarado-Medellín, Marisela: Contributed to conceptualization, review original-draft, sharing findings with the whole research team, provide feedback.

Barrios-Rodríguez, Lilia Gabriela: Data analysis, translation of original-draft, sharing findings with the whole research team.

Availability of data and materials

The information used in this research regarding student dropout rates is available in the evaluation records and the grading platform of the University of Altamira. As for the information related to the activities and their participants, it can be found in the activity log of the STEAM Girls Club.

These results were handled by the author and co-authors, respecting confidentiality at all times, as well as the university's privacy agreement. Microsoft Office Excel was used for the analysis.

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Abbreviations

S-L	Service-Learning Approach
STEAM	Science, technology, engineering, art and mathematics
STEM	Science, technology, engineering and mathematics
UT	Technologic University

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