

Breaking Barriers: Design of a comprehensive EFL e-book to Foster Female participation in STEM for 8th Grade Students at Public Schools in Bucaramanga.

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### **Dedication**

To the girls and teenagers that this E-book may reach, because I dream of us dreaming away from gender bias.

To the incredible women who inspire by making a difference, challenging stereotypes and leading the way for other women.

To my father, for helping me face challenges with courage.

To my mother, for inspiring me every day and filling me with love and coffee during the writing process.

To my little brother, for taking care of me and always being there.



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### **Abstract**

**Title:** Breaking Barriers: Design of a comprehensive EFL e-book to Foster Female participation in STEM for 8th Grade Students at Public Schools in Bucaramanga

**Author:** Daniela Gómez Grajales

**Key words:** STEM, gender gap, equality, Gender study, Gender equality, EFL, EFL material.

**Description:** Science, Technology, Education and Mathematics (STEM) are of utmost importance for our future, yet women's involvement in these fields remains limited due to internalization of gender stereotypes. To combat this issue, education, including English as a foreign language (EFL), should promote women's engagement in STEM and challenge these stereotypes. Therefore, this Design-Based Research (DBR) mixed-methods approach study applied the necessary knowledge to create an EFL e-book for eighth-grade students in public schools in Bucaramanga, aiming to encourage female participation in STEM. The initial step involved identifying and organizing the required knowledge through a literature review and surveys conducted among a sample of 10 eight-grade teachers from various public institutions in Bucaramanga and 77 students from Damaso Zapata School. Subsequently, an e-book plan was formulated based on findings from the initial phase. The final phase encompassed the implementation of the plan, to produce the ultimate product. The results indicate that theoretical and procedural knowledge required for the e-book falls into three categories: STEM background, gender gap's reasons, and designing EFL material to encourage women's participation. Knowledge includes teachers' and students' specific needs, such as the adaptation of the eBook to auditory- visual learning styles and the prevention of the internalization of stereotypes, considering that both genders show a shared interest in STEM. Additionally, the planning of this e-book follows specific recommendations for encouraging women's participation and creating EFL material, which ought to be applied in association with graphic design principles and tools.

\* Bachelor Thesis

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## Resumen

**Título:** Breaking Barriers: Design of a comprehensive EFL e-book to Foster Female participation in STEM for 8th Grade Students at Public Schools in Bucaramanga

**Autor:** Daniela Gómez Grajales

**Palabras clave:** STEM, Gender study, Gender equality, EFL, EFL material

**Descripción:** La ciencia, la tecnología, la educación y las matemáticas (STEM) son de suma importancia para nuestro futuro, pero la participación de las mujeres en estos campos sigue siendo limitada debido a la interiorización de los estereotipos de género. Para combatir este problema, la educación, incluido el inglés como lengua extranjera (EFL), debe promover la participación de las mujeres en STEM y desafiar estos estereotipos. Por lo tanto, esta investigación basada en el diseño (IBD) con un enfoque de métodos mixtos aplicó los conocimientos necesarios para crear un e-book de EFL para estudiantes de octavo grado en escuelas públicas de Bucaramanga que fomente la participación femenina en STEM. El paso inicial consistió en identificar y organizar el conocimiento requerido a través de una revisión bibliográfica y encuestas realizadas a una muestra de 10 docentes de grado octavo de varias instituciones públicas de Bucaramanga y 77 estudiantes del Colegio Dámaso Zapata. Posteriormente, se formuló un plan de libro electrónico basado en los hallazgos de la fase inicial. La fase final comprendió la implementación del plan, para elaborar el producto final. Los resultados indican que los conocimientos teóricos y procedimentales necesarios para el libro electrónico se dividen en tres categorías: antecedentes STEM, razones de la brecha de género y diseño de material EFL para fomentar la participación de las mujeres. Los conocimientos incluyen las necesidades específicas de profesores y alumnos, como la adaptación del libro electrónico a los estilos de aprendizaje auditivo-visual y la prevención de la interiorización de estereotipos, teniendo en cuenta que ambos géneros muestran un interés compartido por STEM. Además, la planificación de este libro electrónico sigue recomendaciones específicas para fomentar la participación de las mujeres y crear material EFL, que deberían aplicarse en asociación con principios y herramientas de diseño gráfico.

\*Trabajo de Grado

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## **Introduction**

In recent years, much recognition has been given to Science, Technology, Engineering, and Mathematics disciplines (STEM), as they perform a crucial role in shaping our society and driving innovation in various sectors, which is necessary for inclusive and sustainable communities (UNESCO, 2017). However, the persistent gender gap hinders inclusive and equal progress, as there is an under-representation of women in STEM-related fields. According to UNESCO (2017, p.11), women represent only 35% of STEM students in higher education worldwide, with a similar figure of 36% in Bucaramanga (SNIES, 2022) (see section 2.1.2.3.2). This difference in the number of representatives from STEM disciplines makes up a major gender gap in the field.

Public awareness of the gender gap in STEM has led to research on its causes along with strategies and suggestions for lowering it at the global, national, and regional levels. Gender stereotypes that associate STEM disciplines with masculinity contribute to the underrepresentation of women in these fields. This phenomenon is partly due to the internalization of such stereotypes by women, which results in a “self-selection bias” (UNESCO, 2017) that drives them away from participating in these disciplines (Colombian Ministry of Education & Siemens Stiftung Foundation, Latin America Regional Office, 2021; Olsson & Mariny, 2018; UN Women, 2020). This tendency is evident in Colombia where, for instance, 52% of young women opt out of pursuing ICT jobs due to gender stereotypes (MIN TIC, nd, as referenced in Government of Antioquia, 2018). In the case of Bucaramanga, for example, at a university, students’ decision to pursue STEM careers was influenced by whether their self-perceived performance and interest in mathematics defied gender stereotypes. Students who believed they were good at math and enjoyed it despite gender stereotypes opted for STEM

programs, while those who did not, chose other careers (Acosta, et. al., 2019).

Since biases solidify and resist over time, restricting women's aspirations, efforts to close the gender gap in STEM are largely focused early on life, hence addressing stereotypes early on can empower individuals to make unbiased decisions about their participation in STEM (Ministry of Education of Colombia (MEN) & Siemens Stiftung Foundation, Regional Office Latin America, hereafter referred to as Siemens, 2021). In this context, the national government urges teachers and institutions, as recognized key agents in the education of children and adolescents, to strive to reduce gender disparities in STEM by actively counteracting biases in these fields (MEN & Siemens, 2021). It is therefore imperative that educators in various fields, including language education, address the gender gap in STEM in their educational settings and communities. In line with the above, about the subject of English as a foreign language (EFL) Rashidi & Safari (2011) stress the need for resources that not only foster the development of students' second language skills but also promote a critical understanding of social issues, such as gender inequality in STEM. However, a review of the literature reveals a lack of resources aimed at achieving this goal (see section 2.1.3).

Considering the aforementioned, this project proposes the development of a comprehensive e-book for EFL 8th-grade public school students in Bucaramanga aimed at fostering participation in STEM among women by challenging gender stereotypes, in order to reduce the gender gap in the fields. Considering this, the present study has the following research question: What are the theoretical and procedural aspects required for the creation and design of an EFL e-book directed to 8th-grade public school students to foster female participation in STEM fields?

It is important to note that the project does not aim to implement and evaluate the

effectiveness of the developed teaching resources; its focus is exclusively on the creation of the material itself. Furthermore, it is confined to the context of EFL teaching in the eighth grade for public schools in Bucaramanga, therefore its generalizability to other educational settings or age groups may be limited.

## **1. Justification**

### **1.1. Relevance at Individual Level**

This project is highly relevant for individual students in Bucaramanga due to a significant STEM gender gap (see section 2.1.2.3). Addressing this issue in 8th grade (ages 13-14) helps prevent the internalization of gender stereotypes and supports unbiased capacity development. Around 74% of females show STEM interest at this age (MEN & Siemens, 2021). Gender biases, if ingrained after age 13, reduce interest in STEM activities (UN Women report, 2020). Career aspirations start getting formed at this age, making it crucial to combat gender biases (UNESCO, 2017).

### **1.2. Relevance at Society Level**

#### ***1.2.1. Human Rights and Sustainable Development***

Promoting female STEM involvement has broad social benefits, supporting human rights and sustainable development. The UN prioritizes education in the 2030 sustainable development agenda and as a fundamental right (UN, 1948, as cited in Gobierno de Santander, 2019). The Colombian Constitution also recognizes it as both a personal right and a public service (1991, as cited in Gobierno de Santander, 2019, p.24). Moreover, UN WOMEN (2020) establishes gender equality as a Sustainable Development Goal (SDG), emphasizing equal rights and opportunities. Therefore, this project contributes to two UN SDG: gender equality and quality education.

At the educational level, this research enhances the provision of high-quality education and empowers the role of teachers in addressing social issues. Adopting a gender perspective in STEM education enhances education by adhering to UNESCO's definition of quality education,

emphasizing resources and support for equity (UNESCO, 2007, as cited in Government of Santander, 2019, p.24). This initiative boosts the educational role of teachers by promoting equity and rights. Teachers can have a substantial effect on closing gender gaps by aligning their influence with social objectives (Alan et al, 2018, cited in Gobernación de Santander, 2019, p.25).

### ***1.2.2. Science***

At the scientific level, fostering women's participation in STEM elevates STEM accomplishments and advances scientific preeminence (UNESCO, 2017, p.15). A more diverse workforce, including more women in science, promotes creativity and innovation (Khan & Ginther, as cited in Cortés, 2021), provides better educational opportunities (Burke & Mattis, as cited in Cortés, 2021), reduces bias and leads to more comprehensive solutions (UNESCO, as cited in Cortés, 2021). Narrowing the gender gap in STEM represents a step forward for science.

## 2. Objectives

### 2.1. General Objective

The principal objective of this research is to apply the theoretical and procedural knowledge necessary to develop an EFL e-book for eighth-grade students at public schools in Bucaramanga that fosters female participation in STEM disciplines.

### 2.2. Specific Objectives

Identify the theoretical and procedural knowledge necessary to develop an EFL e-book that encourages female participation in STEM disciplines in students from public schools in Bucaramanga based on a literature review and the application of surveys.

Plan the structure of an e-book that comprehensively encourages the participation of women in STEM disciplines, based on the theoretical and procedural findings.

Develop the public access e-book together with its audiovisual complements (videos and audios), through the application of the planning.

## 3. Theoretical Framework

### 3.1. STEM

#### 3.1.1. *Origin and Disciplinary Spectrum*

Cortés (2021) examines the Colombian STEM university program gender gap. She notes the origin of the term STEM, which stands for Science, Technology, Engineering, and Mathematics. It was coined in the early 1990s in the United States to emphasize the significance of these disciplines (Paige et al., 2019, as cited in Cortés, 2021). The term gained political popularity in reference to the labor market in these fields (DeVries, 2018, as cited in Cortés, 2021). Different interpretations of the term STEM have emerged. In 2021, the MEN & Siemens (2021) introduced a guide for teachers using the term STEAM. This term advocates for the inclusion of the Arts, leading to the adaptation of STEM to STEAM (Yakman, 2008, as cited in MEN & Siemens, 2021).

Likewise, as the definition is not unanimous, neither are the academic disciplines covered. Two relevant international documents centered in STEM and women used as a basis for this research exemplify this fact. On one hand, the UNESCO (2017) report 'Cracking the Code' identifies the fields within STEM disciplines as Health and Welfare; Engineering, Manufacturing and Construction; Natural Sciences; Mathematics and Statistics; and Information and Communication. In contrast, the UN Women (2020) analysis considers UNESCO fields but excludes Health and Welfare (International Standard Classification of Education (ISCED), n.d, as cited in UN WOMEN, 2020, p.17).

For the purposes of the research and given its local focus, this research adopts the abbreviation STEM to refer to the conceptual framework set forth by UN Women (2020), which encompasses Science, Technology, Engineering, and Mathematics. Likewise, it follows Quintero's framework (2022) encompassing STEM knowledge areas such as Engineering, Architecture, Urbanism, and related areas; and Mathematics and Natural Sciences, in addition to including information and communication technology according to the areas of knowledge adopted by the National System of Higher Education Information (SNIES). It is worth noting that while STEM is employed in this study, recommendations and strategies utilizing the STEAM approach from the MEN& Siemens (2021) will also be considered, as it expands upon and enriches the fields of study encompassed by STEM. In a similar way, while the present investigation does not explicitly address health and welfare considerations, it is noteworthy that the current paper alludes to pertinent insights within the domain of STEM, as exemplified by the incorporation of valuable recommendations and guidelines set forth by authoritative entities such as UNESCO (2017) on this particular subject matter.



### ***3.1.2. Significance of STEM in Contemporary Society***

Policy papers, including UN Women (2020), UNESCO (2017), and MEN and Siemens (2021), STEM's significance in contemporary society. STEM is key to global sustainable development, as progress in these fields enhances the accomplishment of other SDG, such as addressing climate change and ending hunger (UNESCO, 2017; MEN and Siemens, 2021; UN WOMEN, 2020). STEM proficiency is crucial for countries to maintain economic competitiveness due to the rapid expansion of science and technology sectors (UN WOMEN, 2020).

### ***3.1.3. Gender gap in STEM***

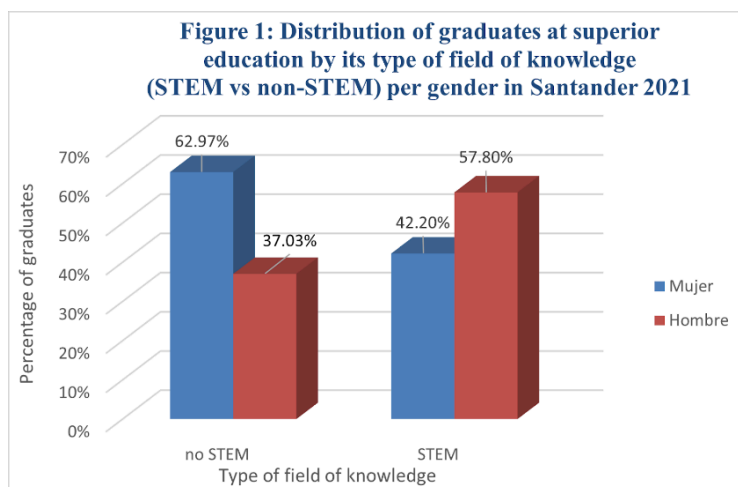
Despite the importance of STEM for the future, significant gender disparities remain in participation. These disparities vary across education and professional sectors, as well as globally, in Latin America, Colombia, and Bucaramanga. The underrepresentation of women in STEM fields is more pronounced when contrasted with their presence in other professional domains.

### ***3.1.4. STEM gender gap at professional level***

The underrepresentation of women in STEM is a global and Colombian concern. Globally, women were expected to make up 35% of STEM graduates by 2020 (UNSD, 2020). In Latin America, women constitute a minority in these fields, especially in engineering, industry, construction, and Information and Communication Technologies, with less than 30% of female graduates (IDB, 2018, cited in UN Women, 2020). In Colombia, women accounted for 35.9% of STEM graduates in 2020 (Cámara Colombiana de Comercio Electrónico, 2022). In Bucaramanga, while the figures are more favorable, gender gaps persist, with 42% of women graduating in STEM in 2022, indicating a 15.6% disparity compared to men (SNIES, 2022), as shown in figure 1.

**Figure 1**

*Distribution of Graduates at Superior Education by its Type of Field of Knowledge (STEM vs non-STEM) per gender in Bucaramanga 2021*



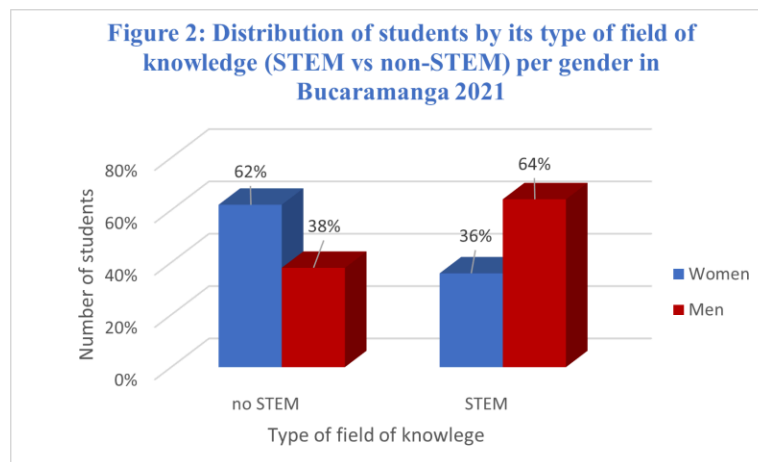
*Note:* Own elaboration based on SNIES data (2022)

### **3.1.5. STEM Gender Gap of Students at Superior Education**

At the higher education level, women remain underrepresented in STEM fields. Globally, they make up just 30% of STEM enrollments (UNESCO, 2017, p. 20). Latin America follows a similar pattern, with men having significantly higher participation in engineering and technology fields, while women tend to gravitate toward gender-associated disciplines (Arredondo Trapero et al., 2019, as cited in Cortés, 2021).

This trend of low female participation in STEM at Colombian universities aligns with global trends. In 2017, only 13.76% of STEM program graduates were women, while men accounted for 35.12% (WEF, 2020, as cited by Cortés, 2021). In the context of Bucaramanga, the gender gap is even more significant, as only 36% of STEM students are women compared to the total number of graduates (SNIES, 2022), as depicted in figure 2.

**Figure 2**



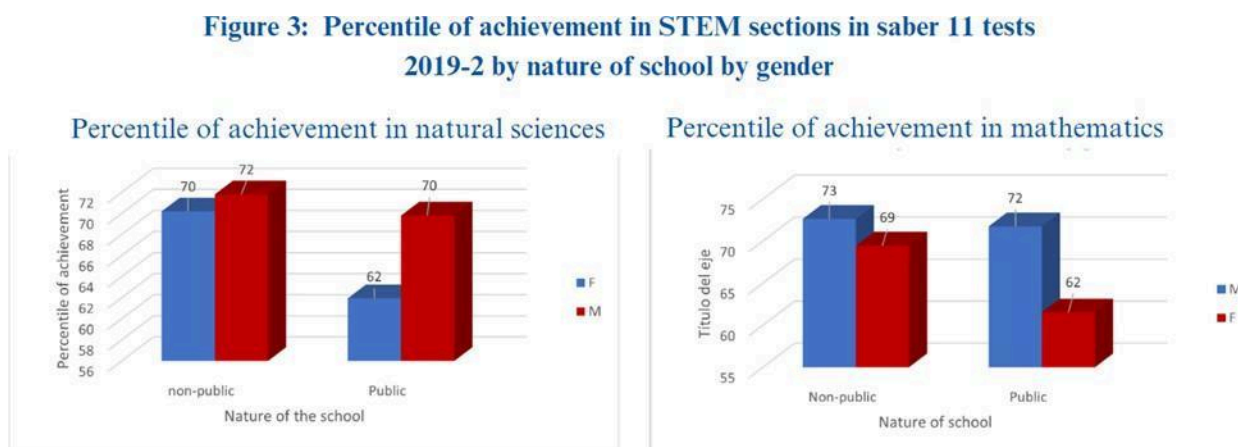
### **3.1.6. STEM Gender Gap at Schools**

The gender gap in STEM at the school level presents a different picture compared to the global scenario. According to the Organization for Economic Co-operation and Development (OECD) report on PISA 2018 test results, 15-year-olds tend to perform equally well in mathematics and science, except in some countries, including Colombia (Schleicher, 2019). These results are also reflected in public schools in Bucaramanga where, based on data from the latest available Saber 11 test (2019-2) in Datos Abiertos (2020), the results show a difference by gender in both the mathematics and natural sciences sections. Female students in these schools scored lower compared to their peers in non-public schools and, in general, compared to male students in both types of schools. Specifically, female students in public schools scored 10 points lower than their male peers in the math section and 8 points lower in the natural science section.

(Datos abiertos, 2020), as shown in Figures 3 and 4.

**Figure 3**

*Percentile of achievement in STEM sections in saber 11 tests 2019-2 by nature of school by gender*



Source: Own elaboration based on Datos abiertos (2020)

### ***3.1.7. Increase of gender gap as women age***

A disconcerting observation in relation to the above results concerns grade 11, where a gender gap in STEM is already established. However, UN Women (2020) found that girls' interest in STEM subjects declines disproportionately to that of boys as they age. For example, although 74% of girls up to eighth-grade express interest in STEAM subjects, only 0.4% of adolescent girls pursue careers in these fields after leaving school. Another example of this is that in the United Kingdom, while both boys and girls were equally engaged in STEM at ages 10-11, by age 18, girls' participation in advanced STEM studies had declined to 19% (UNESCO, 2017).

### ***3.1.8. Gender Stereotypes Influence on STEM gender gap***

This growing STEM gender gap is not due to cognitive differences but results from the influence of stereotypes associating STEM with masculinity (UNESCO, 2017). Other authors

also found that when gender stereotypes are internalized, they make people tend to gain interest and abilities in areas socially associated with their gender (UNESCO, 2017; UN Women, 2020; MEN and Siemens, 2021; Government of Santander, 2019; Olsson & Mariny, 2018). Thus, women tend to pursue non-STEM careers in fields of knowledge such as health and welfare; social sciences, journalism, communication, and education (Olsson & Mariny, 2018). This explains that, as mentioned before, 52% of young Colombian women do not pursue careers in information technologies because they perceive them as “careers for men.” (MINTIC, n.d, as cited in Government of Antioquia, 2018).

Internalized gender stereotypes, among other factors, not only account for the STEM gender gap but also its growth over time (UNESCO, 2017; UN Women, 2020). MEN and Siemens (2021) indicates that stereotypes solidify with age and identity formation, causing women to internalize a perception of unsuitability for STEM. Addressing these stereotypes early can prevent internalization and promote decisions based on capabilities rather than societal roles (MEN and Siemens, 2021). For this reason, efforts should be focused on challenging stereotypes and social norms, as well as encouraging women’s participation in STEM activities (UN Women, 2020, p. 36), especially from a young age as early education impacts identity construction and the promotion of experiences that favor the deployment of all capacities and abilities (MEN & Siemens, 2021).

### ***3.1.9. Recommendations on the Design of EFL material to encourage women's participation in STEM***

This section provides procedural and theoretical recommendations specifically on how to encourage women's participation in STEM to reduce gender inequity in this area, as well as on how to create a pedagogical e-book in EFL. A summary figure of the following recommendations based on suggestions from Freire (1970), Giroux (2011), UNESCO (2017),

UN Women (2020) & Aguirre et. al (2022) is presented in table 1. Please note that the recommendations will be discussed in more detail in the following sections.

**Table 1**

*Recommendations on the design of EFL material to encourage women's participation in STEM.*

<b>Recommendations on the design of EFL material to encourage women's participation in STEM.</b>					
<b>Objective</b>	<b>Fostering Female participation</b>				<b>EFL Material design</b>
<b>Author(s)</b>	Freire, 1970; Giroux, 2011 (Critical pedagogy)	UNESCO, 2017 and UN Women 2020	UNESCO, 2017	UN Women, 2020	Aguirre et al., 2022
<b>Recommendations</b>	Challenge stereotypes through discussion of thought-provoking questions about roles in society	Project female STEM role models girls can identify with	Include girls in inquiry-based , hands-on writing projects	Share talks and debates with vocational matters	Identify students and teachers needs through data collection instruments

	Provide understanding of contemporary local cultural and political concerns	Avoid gender stereotypes in the classroom	Connect girls with local scholarships, grants, and mentoring programs.	Exchange of experiences around STEM	Stablish learning objectives
			Increase females' exposure to experiences in STEM		Choose a lesson planning model
			Take STEM outside the classroom		Implement graphic design recommendation such as rule of third, numbered activities, do not use too many fonts

### ***3.1.10. Addressing the gender gap in STEM from EFL classrooms***

This literature review identified a lack of sources that address promoting women's participation in STEM from an ESL or EFL perspective or provide insights on creating materials for this purpose. Although multiple sources provide suggestions for encouraging women's participation in STEM, they do not concentrate on the function of ESL or EFL guidance in attaining this objective. This section incorporates recommendations for addressing the gender gap, although not from an EFL perspective; as well as EFL ideas on how to incorporate social issues into the pedagogical curriculum.

Critical pedagogy (CP), as a teaching approach, aims to tackle social issues by developing students' critical consciousness and promoting social justice, enabling them to combat injustices and confront power structures (Giroux, 2011). It challenges social inequalities and supports social justice (Giroux, 2011). CP has the potential to be implemented in reducing STEM gender inequality as it involves challenging stereotypes and biases, one of the reasons why women participate less in STEM (see section 2.1.2.5). This approach recommends educators to encourage students to challenge stereotypes and the status quo through the discussion of thought-provoking questions about individuals' roles in society, as well as providing understanding of contemporary local cultural and political concerns (Freire, 1970; Giroux, 2011). About CP, Giroux (2010) states that:

In other words, it is concerned with providing students with the skills and knowledge necessary for them to expand their capacities first to question the deep-seated assumptions and myths that legitimate the archaic and disempowering social practices structuring every aspect of society and then to take responsibility for intervening in the world they inhabit (p. 718).

UNESCO (2017) and UN Women (2020) prioritize reducing the STEM gender gap, offering actions including fostering STEM interest and mitigating the "self-selection bias"



(UNESCO, 2017). These strategies can be applied in e-book development. Recommendations encompass presenting relatable female STEM role models, avoiding gender stereotypes in the classroom, showing images of both genders in STEM fields, eliminating gender hierarchies, and conveying the message that science is for everyone (UNESCO, 2017; UN Women, 2020). UNESCO (2017) also suggests increasing female exposure to STEM experiences through inquiry- based projects, taking STEM beyond classrooms, and connecting women with mentorship, scholarships, and fellowships in STEM. UN Women (2020) complements these efforts by suggesting promoting talks, debates, and experience-sharing in vocational fields.

### ***3.1.11. EFL Material Design Recommendations***

Aguirre (2022) provides key recommendations for the design of pedagogical materials for teaching English in Colombia. First, the author recommends identifying student and teacher needs using tools like questionnaires and interviews to comprehend the sociocultural context, learning preferences, motivation, teaching strategies, values, and local and national EFL policies. Second, she highlights the importance of setting learning objectives, understanding that it is what the student is expected to learn, in terms of a communicative goal. In addition, the author suggests the application of a lesson plan model. She introduces the ESA approach, comprising three stages: Engage, Study, and Apply, as defined by Harmer (1998). The "Engage" stage aims to stimulate learners' interest with engaging activities, "Study" involves acquiring language skills under the teacher's guidance, and "Apply" encourages the effective use of language in real contexts, enhancing communicative competence. Finally, Aguirre et al (2022) offers, some graphic design suggestions, such as the use of the rule of thirds, consistent typography, and numbering exercises.

## **4. Conceptual Framework**

### **4.1. Gender Equality**

Gender equality, defined by UN Women (2020), involves balancing rights, responsibilities, and opportunities between men and women while recognizing diversity among gender groups and advocating for human rights and sustainable development (UN Women, 2020; UNESCO, 2017). Encouraging women's STEM participation aligns with gender equality, challenging stereotypes, and promoting equity. This project employs educational resources to address disparities, underscoring education's role in supporting the UN perspective on gender equality.

### **4.2. Gender Parity**

Gender parity, linked to gender equality, highlights the numerical balance between men and women and is relevant to this research as it seeks to address gender imbalances in STEM (UN Women, 2020). The goal is to boost female participation in STEM and improve gender parity in these fields. The pedagogical material developed aims to challenge gender stereotypes and promote female students' participation, contributing to gender parity in STEM.

## **5. Legal framework**

This section establishes a legal framework behind this research, compiling national and international declarations, initiatives, and laws regarding education, gender equality, STEM, as well as Colombian legislation regarding copyright to create a legitimate material development. Appendix A summarizes the entities, years, names of laws, initiatives, and declarations, as well as a summary of these. This appendix is divided into:

- a) International declarations relating to STEM, gender equality and education.
- b) International initiatives that cover Colombia. Refers to grants and resources available to advance gender equality in STEM.

- c) National and departmental laws related to gender equality in STEM and guidelines on copyright, to guide the ethics and legality of the e-book.

Based on the legal framework of copyright use, the e-book is defined as a pedagogical and non-profit work that cites all the material used. Additionally, it was concluded that in order to edit a large amount of material from the same source, it is necessary and ethical to request authorization for it, Appendix B contains such authorization.

## **6. Methodological Design**

### **6.1. Type of Research**

The research methodology employed in this study is Design-Based Research (DBR), a mixed-methods approach that is particularly suited to the objectives of this project. As outlined by Anderson and Shattuck (2012), DBR is characterized by its practical focus on addressing real-world problems in educational settings through the iterative design and testing of solutions. This is consistent with the present research, which seeks to contribute to the development of a social problem through the creation of educational material.

The mixed-methods nature of DBR is evident in the use of both qualitative and quantitative research methods. The literature review constitutes the qualitative component, providing a comprehensive understanding of the theoretical underpinnings necessary for the development of the EFL e-book. On the other hand, the surveys represent the quantitative component, offering empirical data on the procedural knowledge required for the e-book's development.

### **6.2. Population and Sampling**

The research population consists of eighth-grade students from public schools in Bucaramanga since the e-book is directed to this specific demographic. This choice is based on two key factors: firstly, the recognition of the eighth grade as a critical age for addressing and

challenging gender stereotypes; and secondly, the observation that public schools exhibit a wider gender gap compared to private schools among female students. The choice to use convenience sampling in this research, involving 10 teachers from different public institutions in Bucaramanga and 77 students from Damaso Zapata School, is based on the accessibility and ease of access to these sources. The researchers were able to establish more direct connections with teachers at Dámaso Zapata Educational Institution and INEM Educational Institution, which simplified data collection.

### **6.3. Data Collection Instruments**

The main data collection instrument for this research project is a comprehensive literature review, which will examine relevant literature, research papers, reports, and educational resources to gain valuable insights for achieving the main purpose of this research. The review will help to identify the theoretical and procedural knowledge necessary to develop the e-book, ensuring later, that developed material follows established principles and incorporates strategies to promote female participation in STEM fields among 8th grade EFL students in the Santander region of Colombia.

Once the literature review establishes the theoretical and procedural knowledge fundamental to the creation of the e-book, the researcher proceeds to deepen into the specific theoretical and procedural needs of teachers and students from public institutions in Bucaramanga through the use of surveys.

Therefore, the surveys' sections and objectives were designed based the literature review and they are defined in table 2.

**Table 2***Surveys' sequence*

<b>Section</b>	<b>Section's name</b>	<b>Objective</b>	<b>Sub-sections and question number (expressed in brackets)</b>
<b>0</b>	Description	Informs about the purpose of the survey, its investigative character and informs about the person in charge of	no subsections, no questions
<b>1</b>	Informed consent	It informs you of your right to participate or not, your possibility to withdraw your participation and its anonymity. Asks if participation is desired	no subsections, (1)
<b>2</b>	Demographic information	Seeks to know the demographic characteristics of the survey respondents.	no subsections (2-3)
<b>3</b>	English language needs	Seeks to know perceptions about English language teaching/learning Includes learner motivations, skills to improve, and resources and activities from learning styles relevant to the e-book based on its effectiveness.	students' motivation on English learning (4-7)
			English skills to improve (8-9)
			preference in resources and activities for learning/teaching English (10-12)

4	Gender-related social needs	Seeks to know the perceptions regarding the approach to gender issues in ESL.	Gender equality in English teaching/learning materials (13-15)
			Addressing issues of gender inequality and inequity in EFL (16-18)
5	STEM and Gender Needs	Seeks to understand perceptions of STEM in relation to the teaching of English.	Knowledge and interest in STEM in EFL (19-27 for students) (19-21 for teachers)
			Knowledge and interest in STEM gender gap in EFL (28-31 for students) (21-24 for teachers)

The surveys were designed based on the Likert scale, which is a popular tool for mixed research because of its reliability in measuring opinions, perceptions, and behaviors objectively (Matas, 2018). In this case, students were given an affirmation and they had to rank from 1 to 5 their level of agreement with the sentence, 1 being “totally disagree”, 2 being “disagree”, 3 being “Neither agree, nor disagree”, 4 being “agree” and 5 being “totally agree”. Both surveys share similar sections, equivalent questions, and the same objectives per section and subsection. The difference is that the questions are formulated from the teacher's perspective when a teacher is consulted and from the student's experience when they are addressed to students. It is important

to note that for some sections respondents are given a brief explanation of the topic to be covered in the following questions. For example, for the "STEM and gender" section, we explained what STEM is and the gender gap in STEM, and then asked if they were previously aware of the issue.

#### 6.4. Resources and Analysis Techniques

The study deals with both qualitative and quantitative data, therefore its organization and analysis vary. On the one hand, the researcher adopts the matrix proposed in Florez & Villamizar's (2023) research, therefore, the matrix is used, as in the previous study, to systematize and manage the large amount of information needed to elaborate a literature review. As in the study by Florez & Villamizar (2023), several online sources will be used, such as research articles, theses, web pages, monographs, and news; these sources were found in various databases (such as JSTOR or ERIC).

The adaptation matrix is composed of six sections. These sections include an overview containing the author, title, year, and resource (a link); the type of resource; the theoretical framework, including the topic; the methodology, including the type of study, data collection methods and participants; the conclusions and the usefulness for our research. The dynamics of the matrix are shown in Figure 4.

**Figure 4**

*Matrix dynamics*

General Description				Theoretical Framework		Methodology		Findings	Usefulness in our research
Author	Title	Year	Source	Type of source	Theme	Type of study	Data collection methods		
Maria Olsson & Sarah E. Martiny	Does Exposure to Counterstereotypical Role Models Influence Girls' and Women's Gender Stereotypes and Career Choices? A Review of Social Psychological Research	2018	<a href="https://www.frontiersin.org/articles/10.3389/fpsyg.2018.02264/full">https://www.frontiersin.org/articles/10.3389/fpsyg.2018.02264/full</a>	Research article	how girls and women in various stages of life's gender stereotypes, self-concepts, and career choices are influenced by exposure to counterstereotypical role models	systematic review	meta-analysis, literature search, and critical evaluation of the existing studies	Girls and women from different age groups, cultures, and educational backgrounds who were exposed to various types of counterstereotypical role models in different settings	role models who challenge gender stereotypes can have positive impacts on women's career and academic choices in STEM
Cortés Barros, V.	La construcción del problema público de la brecha de género en ciencia, tecnología, ingeniería y matemáticas – STEM en las carreras universitarias colombianas.	2021	<a href="https://bdigital.unisternado.edu.co/entitas/publicacion/ea63b0f5-10a1-4f5a-9635-7bd32a4eb2ae">https://bdigital.unisternado.edu.co/entitas/publicacion/ea63b0f5-10a1-4f5a-9635-7bd32a4eb2ae</a>	Research article	the study is the gender gap in STEM in Colombian university careers.	Qualitative study	document analysis and semi-structured interviews	A total of sixteen participants from various fields, including international organizations, academia, the government, and civil society.	A public issue, the gender gap in STEM, has been caused by various individuals with varied goals and viewpoints.
Maria Cristina Quintero Ardila	Universidad líder en Colombia en el cierre de brechas de género en las pruebas estandarizadas de razonamiento cuantitativo para carreras STEM.	2022	<a href="https://nccsia.unia.edu.co/revistas/api/core/bi/bi3eamyb9bb6a92-a3b1-400b-a8a5-ae2f27c09e49/contenido">https://nccsia.unia.edu.co/revistas/api/core/bi/bi3eamyb9bb6a92-a3b1-400b-a8a5-ae2f27c09e49/contenido</a>	research internship report	The research examines how women and men differ in their quantitative reasoning skills for STEM fields in Colombia and how the National University of Colombia contributes to reducing this difference.	Quantitative descriptive study	secondary data analysis of the Saber Pro test results from 2016 to 2019.	Students from 32 higher education institutions in Colombia who took the test.	the gender gap varied depending on the type of test, the area of knowledge, and the level of difficulty

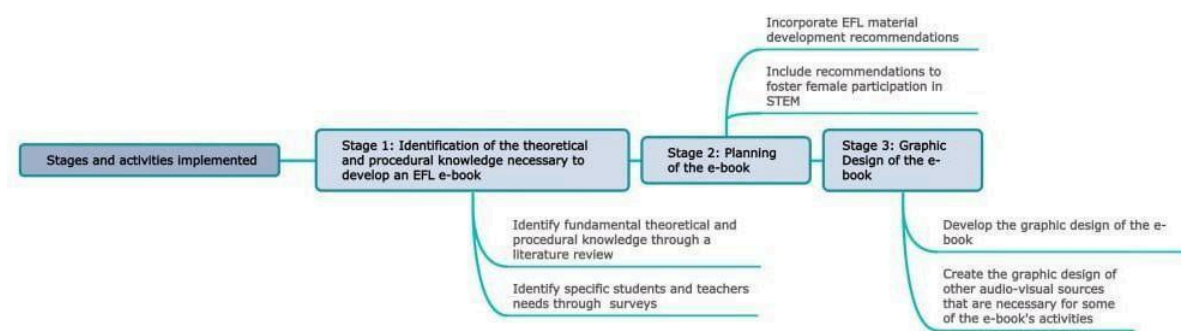
In the quantitative phase of this study, surveys were administered to elucidate the distinct needs of students and teachers pertinent to the development of the e-book. Data from teacher surveys were collected via Google Forms, which were disseminated to the participants. The responses were subsequently downloaded and organized in an Excel spreadsheet. Meanwhile, student surveys were distributed in print format and completed by the participants in person at the Damaso Zapata school in October 2023. Then, the 77 responses were manually tabulated in Excel. Finally, for both teacher and student surveys, Excel was utilized to tally the responses and generate figures, thereby illustrating the perceptions of the participants.

### 6.5. Stages and activities implemented

This research is conducted in three stages adapted from the recommendations on how to create EFL pedagogical material presented above contextualization and documentation, planning, and development.

**Figure 5**

*Stages and activities implemented*



In the first stage, ‘identify the theoretical and procedural knowledge necessary to develop an EFL e-book that encourages female participation in STEM disciplines in students from public schools in Bucaramanga based on a literature review and the application of surveys’ is divided into two stages: 1) a literature review that establishes the fundamental theoretical and procedural



knowledge and 2) the implementation of surveys to teachers and students to determine the specific needs of these groups in relation to the theoretical and procedural knowledge identified in the literature review.

The second stage, planning of the e-book, incorporates other recommendations from Aguirre et al (2022) for the creation of ESL material, in addition to incorporating recommendations for fostering female participation.

The third stage, graphic design, involves the graphic design of the e-book along with videos and audio as input for some listening comprehension activities.

## **7. Findings**

### **7.1. Findings on the identification of theoretical and procedural knowledge**

#### ***7.1.1. Literature review***

The literature review identifies 2 thematic axes around theoretical knowledge for the creation of the e-book, these are: a) Precedents in STEM (origin and disciplinary spectrum, significance in contemporary word, and gender gap statistics) and b) Reasons behind the STEM gender gap (Increase as women age, and gender stereotypes influence). Furthermore, the lit review found a third category with the procedural knowledge needed to design lay down the details of e- book creation (see section 3.5) c) Recommendations on the Design of EFL material to encourage women's participation in STEM (Recommendations to foster women's participation and recommendations for EFL material design).

According to axis 3, the researchers' knowledge necessary for the creation of the e-book is not complete without knowing the specific language and sociocultural needs of the teachers and students of the chosen population (Aguirre et al, 2022). Therefore, a second sub-stage investigated this issue through surveys, inquiring into the sociocultural aspects linked to the gender gap in STEM that were found in other axes of the literature review.

Additionally, must relevant theoretical and procedural knowledge necessary for the creation of the e-book and decisions taken over them are presented below.

The definition of STEM varies, as do the fields of knowledge it encompasses, however this research picks up the definition of STEM as an acronym for Science, Technology, Engineering and Mathematics (Paige et. al, 2019, as cited in Cortés, 2021). There is a local gender gap in STEM due to gender stereotypes related with these areas, which affects various sectors including women from public schools in Bucaramanga (Datos abiertos, 2020). School education plays a fundamental at closing the gender gap, since its role in preventing gender stereotypes that limit women's participation in STEM is fundamental (MEN & Siemens, 2021). However, as there is no ESL material to address this issue, it has been decided to create one. In order to do this, the recommendations on fostering women's participation in STEM by the UNESCO (2017) and UN Women (2020) are used in the planning of the e-book, as well as Aguirre et al (2020) stages and procedures to create EFL material design, including the identification of teachers' and students' needs through surveys. Finally, based on the legal framework of the copyright use, the e-book is defined as a pedagogical and non-profit work that cites all the material used.

### ***7.1.2. Teachers' and students' surveys***

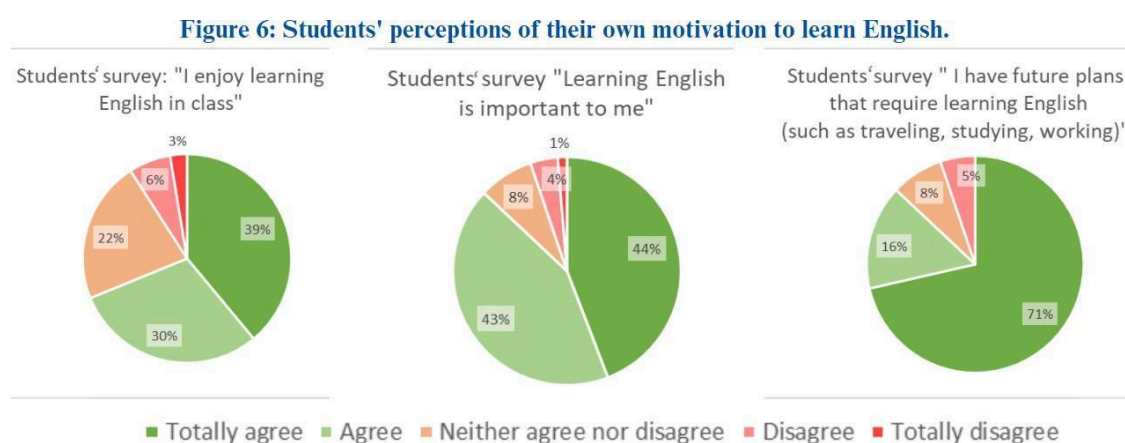
The surveys shed light on different students' and teachers' needs necessary for the creation of the e-book.

Talking about the demographic data, the student survey involved 77 eighth graders at Colegio Dámaso Zapata, consisting of 43 females, 32 males, and 2 non-binary students, averaging 13 years old. Meanwhile, the teacher survey engaged 10 eighth-grade English teachers from two schools, 80% female and 20% male. Their experience varied from less than a year (60%), one to two years (10%), to over two years (30%).

On students' motivation on English learning, the survey results indicate a high level of motivation among students to learn English. A majority of students, 69%, enjoy their English classes, and a significant 87% recognize the importance of English for their future plans, as shown in Figure 6.

**Figure 6**

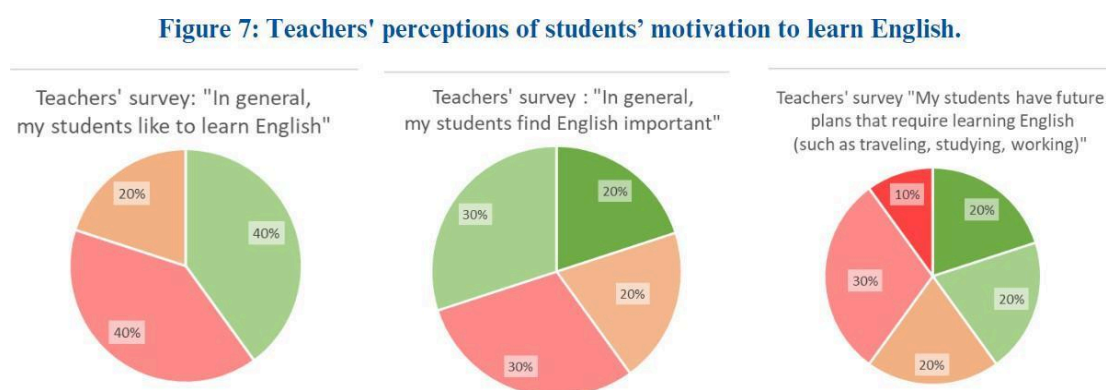
*Students' perceptions of their motivation to learn English*



Teacher perspectives on student motivation to learn English were mixed, as shown in Figure 7. For the statement "In general, my students like to learn English," there was an even split with 40% agreeing and 40% disagreeing, while 20% remained neutral. On the importance of English, 50% agreed, but 30% disagreed and 20% were neutral. Similarly, for "My students have future plans that require learning English," 40% agreed, 40% disagreed, and 20% were neutral

**Figure 7**

*Teachers' perceptions of students' motivation to learn English*

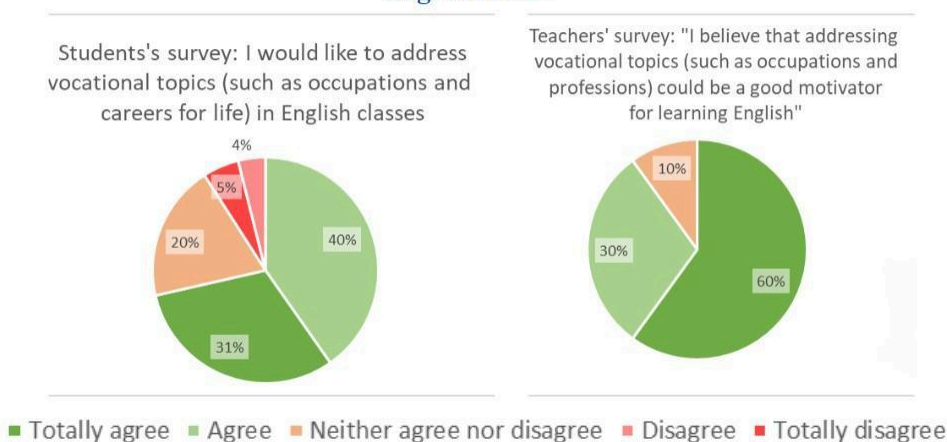


In line with UN Women's recommendation (2020), discussions on vocational topics were emphasized for the e-book's development. Survey question 4 (Figure 8) measure motivation, asking students if they'd like to explore vocational themes in English classes; 55% agreed. Teachers were asked if vocational topics could motivate English learning, and 90% agreed (totally or partially), ensuring the relevance of this thematic for the e-book proposed in this research.

**Figure 8**

*Teachers' and students' perception of vocational topics as a motivator in English Class*

**Figure 8: Teachers' and students' perception of vocational topics as a motivator in English Class**



Referring to English language needs, the second part of the survey focused on students' language needs, including comprehension and production skills, and preferred learning resources and activities. Both teachers and students agreed on the need to improve listening and reading skills, with 100% of teachers and 89% of students partially or completely agreeing. However, production skills were identified as needing the most improvement, with 100% of teachers strongly agreeing and 86% of students agreeing. These results suggest that a well-designed e-book should equally address both comprehension and production skills.

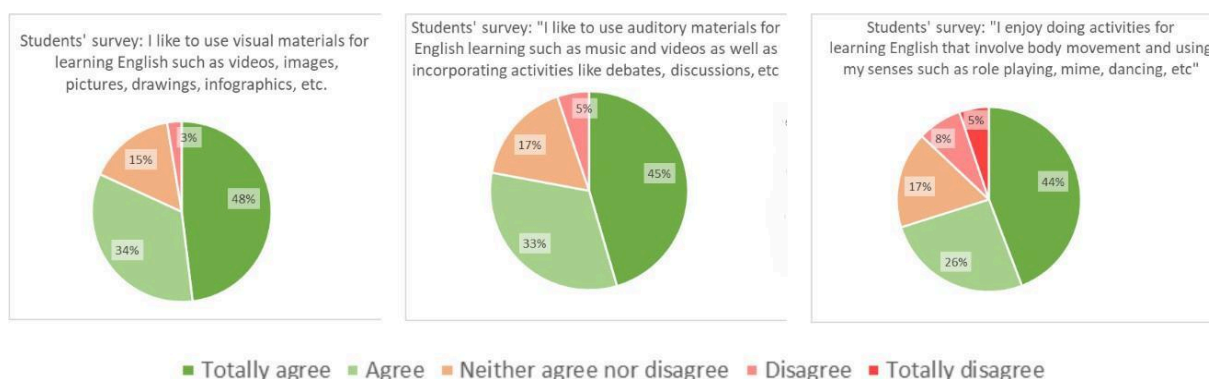
In the section "Preference of resources and activities for learning/teaching English",

students' preferred learning styles were surveyed, based on the 3 styles mentioned by Hu J et al. (2021) kinesthetic, auditory and visual. As shown in Figure 9, students favored the visual style (82%), which includes videos, images, drawings, infographics, etc., and the auditory style (78%), which incorporates music, videos, debates, discussions, etc. The kinesthetic style, involving activities like role-playing, mime, dancing, etc., was least preferred (70%), with 13% of students disagreeing or strongly disagreeing with enjoying such activities.

**Figure 9**

*Students' perceptions of their learning style*

**Figure 9: Students' perceptions of their learning style**



Teacher preferences mirrored student preferences, as shown in Figure 10. The visual learning style was most preferred, with 90% of teachers strongly agreeing and the remaining 10% agreeing. The auditory style was the second most preferred, with all teachers agreeing to some extent, but only 40% strongly agreeing. The kinesthetic style was least preferred, with 80% of teachers agreeing with the related statement.

**Figure 10**

*Teachers' perceptions of materials and activities used in teaching by learning style*



These results guide the selection of materials and activities by emphasizing visual and auditory learning styles, incorporating audio, video, and other audiovisual sources, and developing corresponding activities. Therefore, decisions were made to a) incorporate into the e-book a large number of visual sources such as short comics, icons and images related to the subject matter, vocabulary and grammar, without oversaturating the human eye (an example is shown in Appendix C) b) incorporate visual style activities such as relating images with vocabulary and descriptions, summarizing grammar in graphic organizers, organizing scrambled images, etc. (an example is shown in Appendix D) ; c) Design, together with the e-book, a series of audiovisual media (3 videos and 3 audios) to accompany the e-book exercises, and to publish them together with the e-book in an open access Google Drive folder (evidence is shown in appendix E); d) add auditory activities such as matching the ideas from the audio, matching vocabulary from a video, discussing in peers, presenting a product to the class, etc. (an example is shown in appendix F).

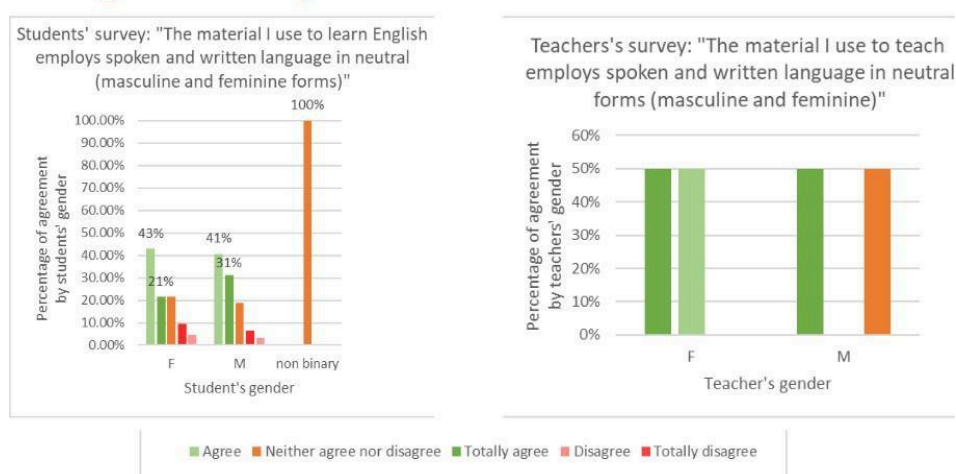
Regarding gender-related social needs, The research article examined perceptions of gender issues in EFL among students and teachers. In the subsection on gender equality in EFL

materials, responses were analyzed by gender. The study found no significant gender differences in perceptions of whether materials use gender-neutral language. Both male and female teachers and students generally agreed that the materials use gender-neutral language, as shown in Figure 11. However, all non-binary students remained neutral on this issue.

**Figure 11**

*Perceptions of students and teachers by gender on gender neutrality in the written forms of EFL materials*

**Figure 11: Perceptions of students and teachers by gender on gender neutrality in the written forms of EFL materials.**



Survey responses also indicated that both students and teachers believe EFL materials present images of men and women equally, with a majority of both genders agreeing. Additionally, the survey found that both genders are depicted at similar hierarchical levels and in non- stereotypical roles. These findings support the decision of continuing promoting EFL pedagogical materials that do not perpetuate gender stereotypes; therefore it is decided to include images of men and women in the e-book (example in appendix G).

Concerning STEM and gender needs, this section aimed to understand perceptions of STEM in relation to English teaching and students' relationship with STEM. In the 'Knowledge

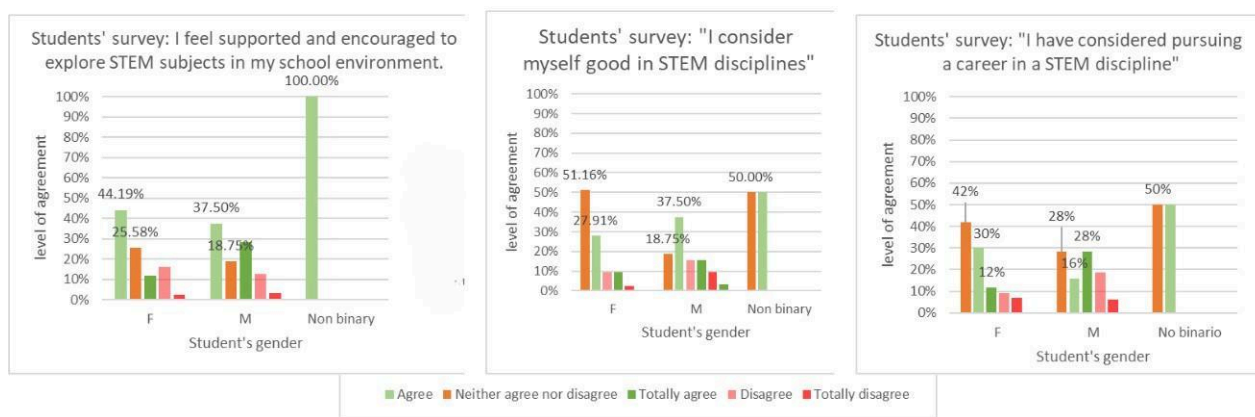
and interest in STEM in EFL' section, 69% of students and 50% of teachers reported prior knowledge of the term STEM. The student survey revealed that a majority of students, regardless of gender, felt supported and encouraged to explore STEM subjects in their school environment. However, women were less likely to consider themselves good at STEM disciplines, with only 36% agreeing, while over half of the men considered themselves good at STEM. Non-binary students were split between neutral and agreement.

Despite these perceptions, there was a significant interest in pursuing a STEM career, with 43% of females, 44% of males, and 50% of non-binary students expressing interest. These findings suggest a need for continued encouragement and support for students in STEM, particularly for female students.

**Figure 12**

*Students' interest in STEM*

**Figure 12: Students' interest in STEM**



The data indicates a significant interest in STEM disciplines among women at this stage, aligning with findings from MEN & Siemens (2021). This underscores the importance of the e-book's role in mitigating potential "self-selection biases" (UNESCO, 2017) that may deter women from participating in these fields (MEN & Siemens, 2021; Olsson & Mariny, 2018; UN Women, 2020).



In this subsection teachers and students were asked the following questions. On the question of whether they had previously addressed the relevance of STEM in their English classes, 80% of teachers expressed disagreement, while students showed 45% disagreeing and 37% with a neutral response. On the other hand, when probing whether they would like to address the topic of STEM relevance in their English classes, 80% of teachers agreed, while students reflected 57% agreed and 34% with a neutral response. From the results, the need for teachers to address this topic in their classes is raised, and it can be seen that part of the student body is interested in the proposal.

Finally, in the "Knowledge of and Interest in the STEM Gender Gap in EFL" subsection, participants were inquired about their prior awareness of gender disparities in STEM, revealing a prevalent lack of knowledge. Specifically, 90% of teachers and 63% of students acknowledged a lack of prior awareness regarding this issue. Additionally, when asked about their willingness to address gender inequality in STEM within English classes, 80% of teachers expressed some level of agreement, while 53% of students exhibited agreement with this prospect.

## **7.2. Findings on planning**

In the e-book planning, recommendations found in the first stage of the research were considered, including recommendations from Aguirre et al (2022) for EFL teaching materials, strategies to address social injustices (Freire, 1970; Giroux, 2011), and promoting female participation in STEM from UN Women (2020) and UNESCO (2017) were considered. Consequently, the following decisions were made:

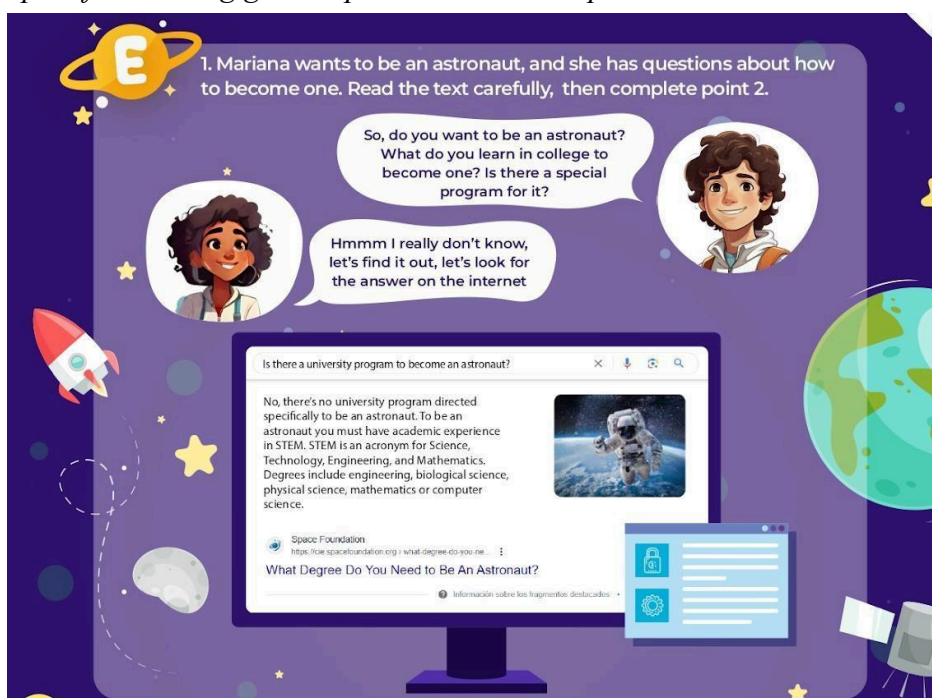
### ***7.2.1. To Enhance girls' Exposure to STEM experiences***

The (UNESCO 2017) recommendation was considered in the e-book, as its primary focus revolves around a central STEM theme, with narratives and activities complementing it. This approach ensures that all students, irrespective of gender, gain knowledge and experience in

these disciplines. An example of this is that the e-book's narrative follows Mariana and Francisco, the main characters, aspiring to be astronauts. As they explore how to achieve their dream, they discover that excelling in STEM fields is the path to becoming astronauts. An example from this narrative is presented in Figure 13.

**Figure 13**

*Example of enhancing girls' exposure to STEM experiences in the e-book*



Note: Own elaboration from the e-book “Universe Xplorers: Breaking barriers, expanding horizons” (2023) page 11.

### **7.2.2. To incorporate gender equality objectives into the e-book sequence**

The e-book sequence was divided into 2 modules and a final reflection (see Appendix H).

Each module has general STEM gender equality goals based on the aforementioned recommendations towards these goals. To see how STEM gender equality goals are linked to different activities see Appendix I.

To illustrate this connection better, it is possible to dive into the goal of "Establishing links to role models they can identify with" (UNESCO 2017) and find that there are different

points in the e-book that show little girls and adult women role models at the international and national levels. The examples of these are shown below in Figures 14,15 and 16

**Figure 14**

*Example at the international level of activity for the goal “Establishing links to role models they can identify with”*

5. Look at the names and pictures in the cards, then match the STEM woman with her achievement. Look at the example

Portrait Label	Portrait Description	Matched Achievement
A. Katherine Johnson	Illustration of a woman with glasses looking at a laptop.	1. She is an astronomer and astrophysicist, she is curious about stars and novae and discover that the stars are composed of 99% hydrogen and helium.
B. Cecilia Payne	Illustration of a woman with a telescope.	2. She is a nun, a mathematician a pioneer of computer science. She participates in the creation of the basic programming language
C. Mary Kenneth	Illustration of a woman in a hijab using a laptop.	3. She is a chemist and X-Ray crystallographer. She is intelligent and she discovers the structure of DNA
D. Rosalind Franklin	Illustration of a woman with a DNA double helix.	4. She is a pioneer in space science and computing. She is brave. She calculates the trajectory for the Apolo 11 flight to the moon.

Note: Own elaboration from the e-book “Universe Xplorers: Breaking barriers, expanding horizons” (2023) page 13.

**Figure 15**

*Example at the national level of an activity for the goal “Establishing links to role models they can identify with”*

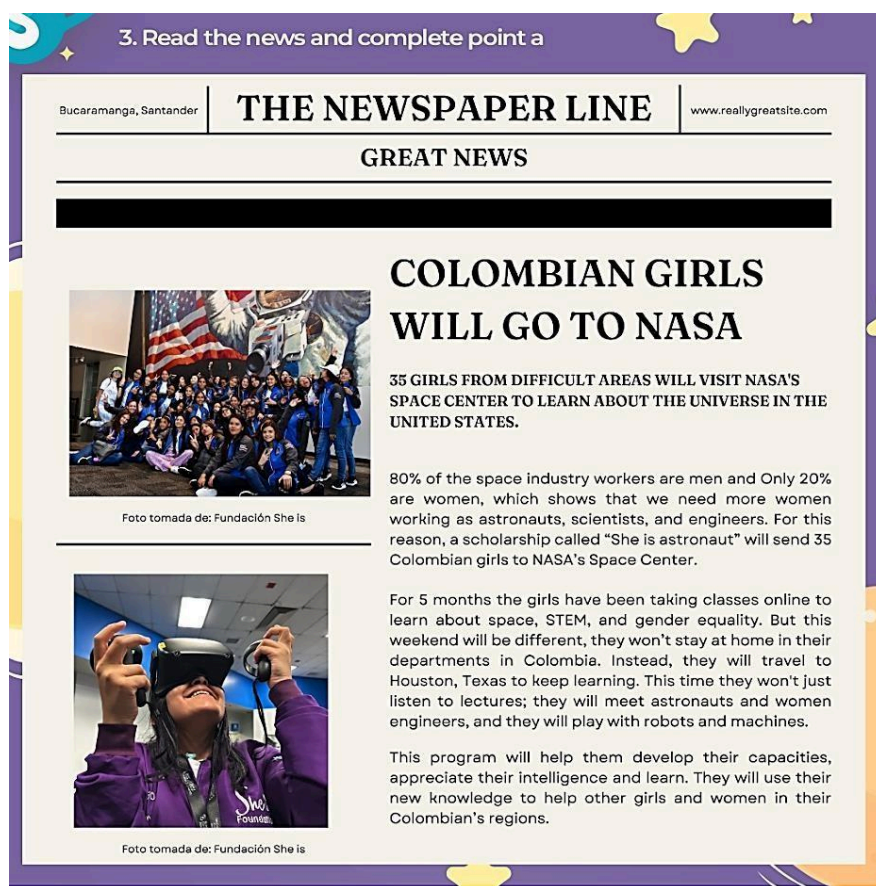
B. Then, watch the role models video (video 2) and complete the table below. Look at the examples

	Name	City	Profession	Qualities
	She is Debora Tejada			
		She is from Bucaramanga		
			She is a professor at Mechanical Engineer School at Universidad Industrial de Santander	
				She is leading Colombian butterfly scientist and biologist

Note: Own elaboration from the e-book “Universe Xplorers: Breaking barriers, expanding horizons” (2023) page 14.

### Figure 16

*Example of a National-level same-age exercise for “Establishing links to role models they can identify with*



Note: Own elaboration from the e-book “Universe Xplorers: Breaking barriers, expanding horizons” (2023) page 38

In addition, each module is divided into 2 or 3 units that take specific gender equality in STEM objective as part of its narrative. Thus, for example, under the recommendation of "Taking STEM outside the classroom" the whole unit 1 of module B shows the narrative of Francisco and Mariana wondering and discovering where science is in Bucaramanga and

showing places in the city to find it. Examples of this narrative are shown in Figures 17, 18 and 19.

**Figure 17**


*Example 1 of the narrative on the specific gender equality in STEM objective of module b, unit 1*

*"Taking STEM outside the classroom"*

4. Look at the following statements and decide if you agree or disagree with them. Justify your answer using the following table as a guide. Look at the example

I really like STEM, but, are there places to learn about, STEM in Bucaramanga?

Phrases for Agreeing	<ul style="list-style-type: none"> <li>- I agree because...</li> <li>- I think it's true because...</li> <li>- I think so too because...</li> </ul>
Phrases for Disagreeing	<ul style="list-style-type: none"> <li>- I respectfully disagree because...</li> <li>- I see it differently because...</li> <li>- I'm not sure about that...</li> </ul>
Justifying	<ul style="list-style-type: none"> <li>- In my opinion...</li> <li>- From my perspective...</li> <li>- Based on what I know...</li> </ul>

Statements	Justification
1. Bucaramanga has good places to do science 	<ul style="list-style-type: none"> <li>• I agree because, for example, UIS has spaces to do STEM</li> </ul>

Note: Own elaboration from the e-book "Universe Xplorers: Breaking barriers, expanding horizons" (2023) page 29.

**Figure 18**

*Example 2 of the narrative on the specific gender equality in STEM objective of module b, unit 1*

*"Taking STEM outside the classroom"*





Note: Own elaboration from the e-book “Universe Xplorers: Breaking barriers, expanding horizons” (2023) page 30.

### Figure 19

*Example 3 of the narrative on the specific gender equality in STEM objective of module b, unit 1*  
*“Taking STEM outside the classroom”*



Note: Own elaboration from the video “Module B, unit 1, exercise 5” of the e-book “Universe Xplorers: Breaking barriers, expanding horizons” (2023).

#### **7.2.3. To establish learning objectives and a lesson planning model**

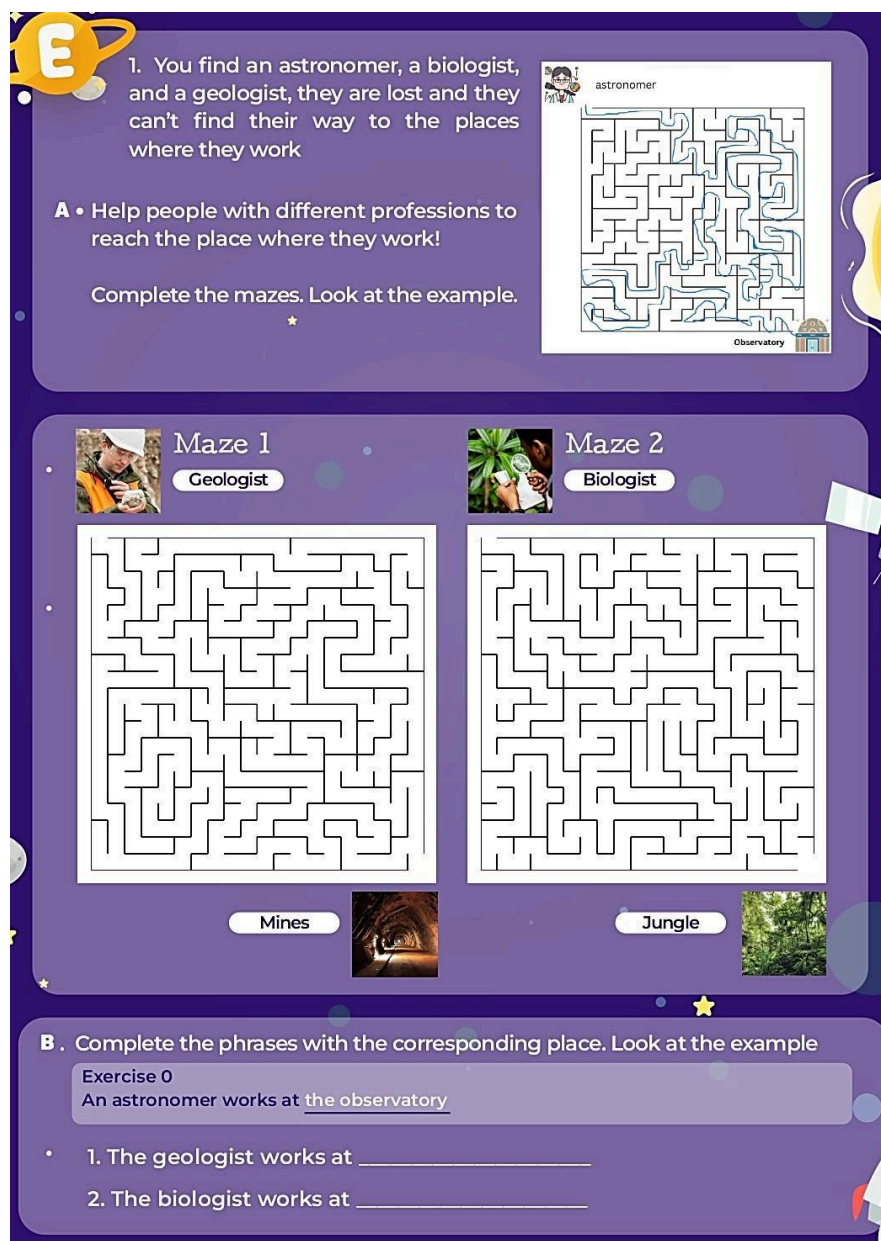
Following Aguirre et al recommendation (2022), each unit from both modules has different learning objectives. These learning objectives were adapted from language functions in the eighth-grade curriculum of the suggested curriculum by the Ministry of National Education (MEN) (2016), formulating them with a communicative approach. Also, grammar and lexis suggested in this document were integrated into the sequence of the e-book to ensure appropriate content for the students’ English level. To find each selection on learning objectives, grammar and lexis per unit see appendix H.

In addition, the lesson planning model “ESA” was selected. This means each unit from both modules has 3 different stages: engage, study, and activate. In the ‘engage’ stage attractive

activities were incorporated, they meant to introduce the vocabulary or topic (Harmer, 1998, as cited by Yifan, 2023), as shown in figure (23).

**Figure 20**

*Engage stage in ESA model applied in the e-book example*



1. You find an astronomer, a biologist, and a geologist, they are lost and they can't find their way to the places where they work

A • Help people with different professions to reach the place where they work!

Complete the mazes. Look at the example.

★

**Maze 1**  
Geologist

**Maze 2**  
Biologist

Mines

Jungle

B • Complete the phrases with the corresponding place. Look at the example

Exercise 0  
An astronomer works at the observatory

1. The geologist works at \_\_\_\_\_

2. The biologist works at \_\_\_\_\_

Note: Own elaboration from the e-book “Universe Xplorers: Breaking barriers, expanding horizons” (2023) page 27.

During the 'study' stage, language skills are further developed with the teacher's guidance, take figure 24.

**Figure 21**

*Study stage in ESA model applied in the e-book example*

6. Complete the phrases with the information on the tickets. Look at the example

**PLANETARIUM**  
Step into the biggest cosmic adventure at the Planetarium UIS, where you'll witness the brightest stars and the most interesting planets

March  
**25**  
2023

UNIVERSIDAD INDUSTRIAL DE SANTANDER  
PUBLIC TICKET  
ONE TICKET FOR ONE PERSON. **\$ 8000**

**SPACE FESTIVAL**  
Ticket Number: 1234567890

**WELCOME TO THE NATURAL HISTORY MUSEUM**  
Get ready for an adventure at the most incredible museum in Bucaramanga! Witness the strangest and the oldest creatures that have ever existed right in your city

25 JUNY 2022  
**ADMIT ONE**  
CODE : 123-456-789

**Exercise 0**  
Step into the biggest cosmic adventure at the Planetarium UIS

1. You'll witness \_\_\_\_\_ stars
2. You'll witness stars and \_\_\_\_\_ planets.
3. Get ready for an adventure at \_\_\_\_\_ museum in Bucaramanga!
4. Witness \_\_\_\_\_ ... creatures
5. Witness the strangest and \_\_\_\_\_ creatures

Note: Own elaboration from the e-book “Universe Xplorers: Breaking barriers, expanding horizons” (2023) page 32.

During the 'engage' stage, language skills are used for a practice purpose, teacher only intervenes if necessary (Harmer, 1998, as cited by Yifan, 2023)

#### **7.2.4. To encourage discussion of STEM gender gap**

Recognizing that gender stereotypes contribute to the STEM gender gap, researcher decided to introduce discussions about this issue in the EFL e-book. This approach is influenced



by Giroux's (2011) CP, which involves challenging gender stereotypes through discussions and thought-provoking questions about the STEM gender gap in students' contexts, as well as the underlying scientific principles. Module A, Unit 3, titled "Pink for Girls, Blue for Boys: Is It Always True?" implements CP recommendations, exploring the theme of gender stereotypes and its influence on STEM gender gap. For example, the first point (figure 25) presents scientific data from the current research about the percentage of women in Bucaramanga who are studying STEM, offering local insights into the issue. It then encourages a respectful classroom discussion by posing a thought-provoking question: "If women can also excel in STEM, why do more men tend to opt for this field?" and ask students to talk politely and calmly.

**Figure 22**

*Example of CP in the e-book*

**UNIT 3 : Pink for girls, blue for boys, is it true?**

**DID YOU KNOW?**

**In Bucaramanga**

- Woman represent only 36% of STEM students
- While men represent the 64%

**E** 1. Mariana and Francisco are debating the question: "If women can also succeed in STEM, why do more men end up in that field?"

**A.** What do you believe? Think about it and write down your answer. You can start with phrases like "I think", "I consider", "In my opinion". Remember to express yourself politely.

Look at the example

In my opinion, there are more men than women in STEM fields because it is harder for women to enter this field.

**B.** Share your answers with your classmates and have a fun chat. Be sure to talk kindly and be respectful with each other.

**C.** Listen to Mariana and Francisco's ideas.

Note: Own elaboration from the e-book "Universe Xplorers: Breaking barriers, expanding horizons" (2023) page 18.

### 7.3. Findings on developing the graphic design of the E-book

Following Aguirre et al (2022) recommendations, basic graphic design concepts were applied for the e-book to be user-friendly and visually appealing. The exercises are numbered for the convenience of teachers and students, facilitating their comprehension of the activity structure and the corresponding answer key. Constant typography (Montserrat) and the rule of thirds guide students' focus to key elements on pages or activities (see Appendix J). In addition, for the development of the e-book and the images and videos that accompany it, different applications and web pages were used, such as Adobe illustrator, Canva, Capcut (see figure 26).

**Figure 23**

*Graphic design on Adobe illustrator*



The name of the tools and its application description can be found in Appendix K. With the aforementioned procedures applied, the e-book was finally finished, to use it you can see appendix L. Furthermore, to download it you can enter in the google drive folder which contains the e-book and its audios and videos <https://drive.google.com/drive/folders/1tnjFv6-W02gDkBlrxek0PbYFmDAe66Q>

## **8. Conclusions & recommendations**

This research applied the theoretical and procedural knowledge needed to develop an EFL e-book that encourages female participation in STEM disciplines for eighth-grade students in Bucaramanga public schools.

First, the theoretical and procedural knowledge necessary for the development of the e-book was identified and categorized based on a literature review into 3 axes: precedents in STEM, reasons behind the STEM gender gap and EFL material design to foster women's Participation in STEM. This last one suggested that the knowledge should also include the targeted students' and teachers' sociocultural and language needs, thus, at this stage, surveys were also conducted and analyzed, indicating a preference for an audio-visual learning style in the e-book. Also, while surveys conducted in this phase revealed that students displayed interest in STEM without gender distinctions, women exhibited lower confidence in their perception of their performance in these fields, this first stage was fundamental as it allowed researchers to make informed decisions and design methodological steps to achieve the general objective. Secondly, it planned the structure of the e-book based on theoretical and procedural findings from the recommendations to foster women's participation and to create EFL material design found in the first stage. Finally, the researcher proceeded to the application of the e-book planning, exercising graphic design fundamentals and using apps and web pages to produce the final product.

Although this study has some limitations, it as well offers opportunities for future research. These include extending the application of the e-book to a wider range of educational contexts and demographics, considering it is not currently possible. In addition, future studies

could explore the practical application of the e-book in classrooms, assessing its effectiveness and measuring its impact on female participation in STEM disciplines.

In conclusion, this research represents a significant step toward encouraging female participation in STEM and contributes to breaking the STEM gender gap within public 8th grade EFL classrooms, it launches the path towards creating EFL materials focused on STEM gender equality, a path that was previously non-existent, and extends the invitation to future studies to build on this foundation.

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## Appendix A

### *Legal Framework*

Entity and Year	Name	Unit
<b>International Declarations</b>		
<b>UN Women, 1995</b>	Fourth World Conference on Women	Determines specific recommendations meant to increase women's involvement and persistence in the fields of science and technology (UNESCO, 2017. pp 38)
<b>UN, 2015</b>	The United Nations General Assembly	Establishes education and gender equality as part of the 2030 Agenda for Sustainable Development (UNESCO, 2017. pp 4)
<b>UNESCO, 2016</b>	Education for People and Planet	Members adopted an active role in fostering girls and women to be leaders in STEM (UNESCO, 2017. pp 4)
<b>International Initiatives</b>		
<b>UNESCO, 2015</b>	SAGA project	Provides instruments to close the gender gap in Science, Technology and innovation at all levels of education and research (UNESCO, 2017).
<b>Geek Girls Latam, 2016</b>	NGO creation	Consolidates its position as an NGO. This company has been joining forces for 11 years for diversity, equity, and inclusion of women in STEAM areas for Leadership, its results show that to date 3800 girls and women have been directly impacted. (Geek Girls Latam, 2016)
<b>British Council, 2023</b>	British Council	Offers scholarships to women from different parts of the world in order to pursue a master's degree in a STEM program at a leading UK university. (British Council, 2019)
<b>Colombia's Laws</b>		
<b>Colombian Congress, 2017</b>	National Development Plan 2018-2022	The "Equity Pact for Women" chapter establishes strategies to increase women's access and permanence in the education system and encourage occupational and professional diversification, including greater participation in STEM careers (Cancillería, 2020).

<b>Government of Santander, 2019</b>	Ten-year equal opportunity plan 2020-2029 Santander public policy for women and gender equity	Establishes as a desired situation in the educational axis that "in all the territories of Santander, girls, and women have an educational system ... that stimulates their scientific training as a life project, as well as their participation in careers related to science, technology, engineering and mathematics" (2019, Government of Santander. p.30).
<b>Colombian Congress, 1982</b>	Law 23 of 1982. Article 15	Grants copyright to those who adapt works in the private domain with permission but requires that they mention the title and author of the original work when publishing their adaptations.
<b>Colombian Congress, 1982</b>	Law 23 of 1982. Article 32	The use of literary or artistic works, or fragments thereof, for educational purposes in publications, radio broadcasts, or visual and sound recordings is permitted, provided that the limits are justified in terms of the educational purpose. The communication of broadcast works for non-profit educational purposes is also permitted for school, university, or professional training activities, with the obligation to cite the author and the title of the works used (Colombian Congress, 1982)
<b>Colombian Congress, 1982</b>	Law 23 of 1982. Article 31	Allows quoting an author, and transcribing necessary passages, as long as too many passages are not reproduced that could be considered a substantial copy detrimental to the original author. In each quotation, the name of the author and the title of the work cited must be mentioned (Colombian Congress, 1982)
<b>Colombian Congress, 1982</b>	Law 23 of 1982. Article 31	Stipulates that the reproduction, distribution, and dissemination of news or information about events publicly disseminated through the press or broadcasting is legal (Colombian Congress, 1982)
<b>Colombian Congress, 1982</b>	Law 23 of 1982. Article 31	States that the publication of a portrait is permissible when it is associated with scientific, educational, or cultural purposes in general, or with events of public interest or that have taken place in public (Colombian Congress, 1982)

## Appendix B

### *Copyright authorization*

Bucaramanga, 25 de octubre del 2023

Asunto: Consentimiento y Permiso para el Uso de Material Videográfico

Yo, **Vidal Humberto Abreo Becerra** en calidad de director de Comunicaciones doy mi consentimiento a Daniela Gómez Grajales, identificada con C.C. 1000707430 estudiante de la Universidad Industrial de Santander, para utilizar el siguiente material videográfico ubicado en el canal de YOUTUBE de la Universidad Industrial de Santander:

1. "El Planetario UIS vuelve a abrir sus puertas" en el link:  
<https://www.youtube.com/watch?v=NWVLoz1auGE&t=62s>,
2. "Exhibición minerales en la UIS #EstoSíTieneCiencia" en el link  
<https://www.youtube.com/watch?v=jAlFvLHZ6YE&t=14s>
3. "Museo de historia natural UIS #EstoSíTieneCiencia" en el link  
<https://www.youtube.com/watch?v=I6RvYE8Edac&t=45s>

Este material se puede utilizar con fines educativos y de investigación en el proyecto de grado **"Rompiendo barreras: Un diseño integral de material pedagógico para estudiantes de EFL de 8° curso para fomentar la matriculación femenina en STEM."**

La autorización no tiene implicaciones económicas por ninguna de las dos partes, pero si es indispensable que en cualquier presentación, publicación o trabajo derivado del proyecto de grado se mencione la contribución de los videos ubicados en la red social (YouTube) de la Universidad Industrial de Santander.

Cordialmente,



Vidal Humberto Abreo Becerra  
Director de Comunicaciones UIS

## Appendix C

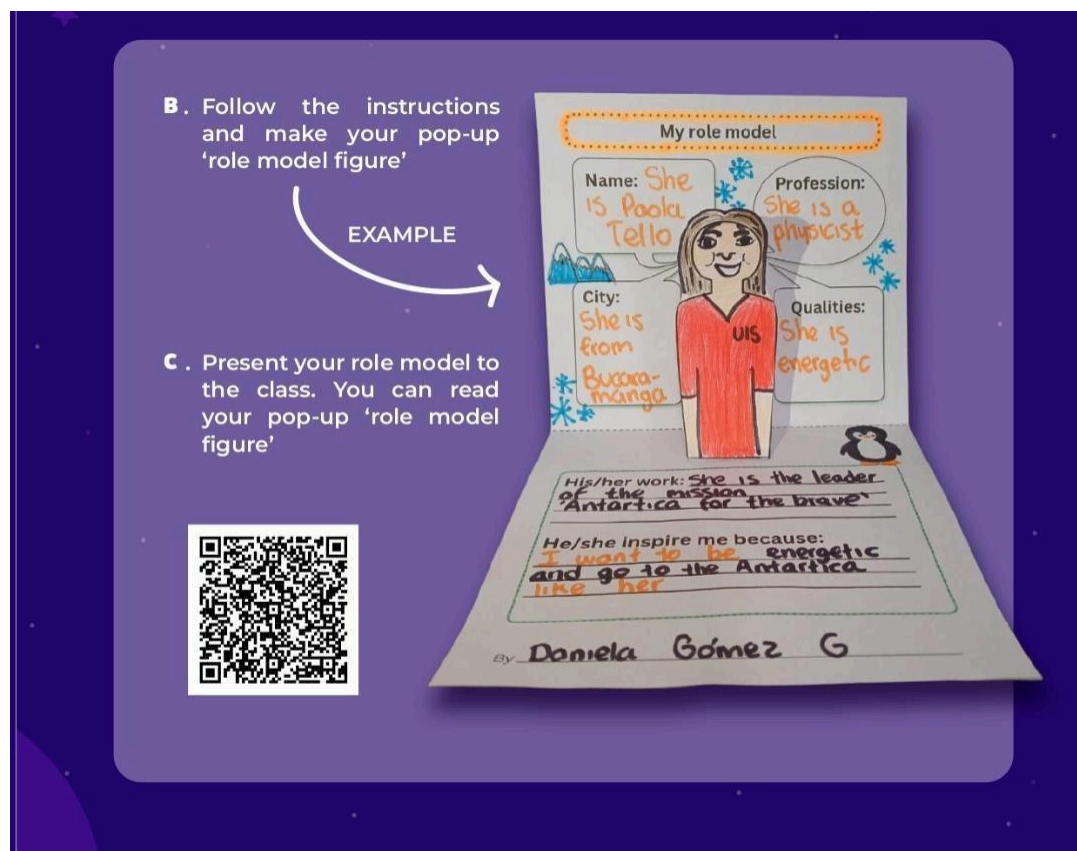
*Comic as an example of visual sources used in the e-book*



Note: page 24 of the e-book

## Appendix D

*Example of visual activities used in the e-book*



Note: In this activity students were ask to create a graphic organizer about a STEM role model.






















Instructions were provided before. Page 17 of the e-book

## Appendix E

*Public drive folder of the e-book and its audio-visual sources*

Compartido conmigo > Space Xplorers ▾

Tipo ▾ Personas ▾ Modificado ▾

Nombre ↑	Propietario	Última modifi...	Tamaño de e	
 E-book.pdf 	 Teacher Dani	6 nov 2023	20,4 MB	⋮
 Module A - Unit 2 - exercise 6a (Video 1).mp4 	 Teacher Dani	1 nov 2023	124,5 MB	⋮
 Module A - Unit 2 - exercise 6b (video 2).mp4 	 Teacher Dani	1 nov 2023	321,8 MB	⋮
 Module A -unit 2- exercise 8 (audio).mp3 	 Teacher Dani	1 nov 2023	848 kB	⋮
 Module A- unit 3 - exercise 1 (audio).mp3 	 Teacher Dani	1 nov 2023	1,2 MB	⋮
 Module B - Unit 1 - exercise 5 (video 3).mp4 	 Teacher Dani	1 nov 2023	220,1 MB	⋮
 Module B-Unit 2-exercise 1 (audio).mp3 	 Teacher Dani	1 nov 2023	1,1 MB	⋮

## Appendix F

*Example of auditory activities in the e-book*

**UNIT 2 : How far do you want to go?**

1. Mariana and Francisco just came from the planetarium. Read the following events and organize them chronologically from 1 to 5 according to the audio.

Look at the example.

0. 4 Mariana doubts she can achieve her dream because she doesn't have a lot of money to study and she thinks there may be little opportunities because there are little women in STEM

1. \_\_\_\_ Mariana says that the planetarium was amazing and that she wants to be an astronaut

2. \_\_\_\_ Francisco says the planetarium was wonderful and that he wants to be an astronaut

3. \_\_\_\_ Mariana and Francisco came from the planetarium

4. \_\_\_\_ Francisco mentions an advertisement

Note: Page 36 from the e-book

## Appendix G

*Example of inclusion of images of men and women in the e-book*



Note: Page 1



## Appendix H

### *Sequence of the e-book*

E-book's sequence					
Module	Gender equality objective	Unit structure			
		Unit's name	Learning objective	grammar :	lexis
Module A. Breaking barriers	- Identifying and challenging gender stereotypes in STEM  - Presenting gender diverse role moles in STEM	Unit 1: Introduction	By the end of this unit I will be able to present myself to a group by describing my interests, desires and talents	- simple present tense [first person singular] - Verb to be [first person singular]	STEM professions (part 1) Verbs about desires Self introduction phrases
		Unit 2: Role models	By the end of this unit I will be able to describe human actions related to academic goals.	- simple present tense [third person singular] - Verb to be [third person singular]	STEM Fields STEM professions (part 2) Verbs about academic development Expressions to give opinions
		Unit 3: Pink for girls, blue for boys, is it always true?	By the end of this unit I will be able yo discuss good and bad practices around gender stereotypes in STEM.	- Comparatives of superiority - Simple present tense	Toys Adjectives related to gender stereotypes
Module B. Expandin g horizons	- Fostering STEM learning outside of the classroom - Promoting regionally focused initiatives - Connecting girls with scholarships, grants and mentoring programs.	Unit 1: STEM in Santander	By the end of this unit I will be able to express facts and opinions	- Superlatives - Present simple	Adjectives to describe things STEM places Verbs about places Phrases to show interest
		Unit 2: How far do you want to go?	By the end of this unit I will be able to express dreams and future plans.	- Future simple	Scholarships and academic development expressions
Reflection		Summary and reflection of the primer			

## Appendix I

*STEM gender equality goals per activities from the e-book*

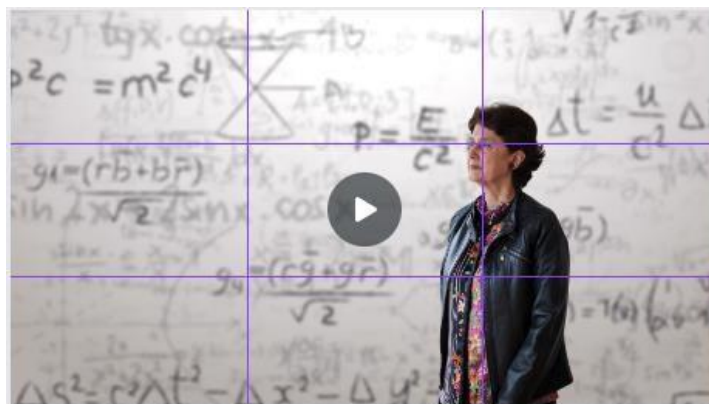
Key		Activity in the book			Gender equality goals addressed
(a)	Project female STEM models	Module	Unit	Exercise	-
(b)	avoid gender stereotypes in the classroom	A	1	1	e
				2	e
(c)	Include girls in inquiry-based, hands-on writing projects			3	a, b, e
		2	1		a, b, e, h
(d)	Connect girls with local scholarships, grants, and mentoring programs			2	a, b, e
				3	a, b, e, h
				4	b, c, e
(e)	Increase females' exposure to experiences in STEM			5	a, b, e,
(f)	Take STEM outside the classroom				
(g)	Share talks and debates with vocational matters				
(h)	Exchange experiences around STEM				
				6	a, b, c, e, g, h
				7	a, b, e
				8	a, b, e
				9	a, b, c, e, g, h

	3	1	c, e
		3	b, c, e,
		4	b, c, g
		7	a, b, c, e, g, h
B	1	4	c, e
		5	e, f, h
		6	c, e, f, h
		8	e
		9	c, e, f, h
	2	1	a, b, c, e, g, h
		2	a, b, c, d, e, f, g
		3	a, b, d, e, f, g
		4	b, c, d, e, g, h
Reflection	-		a, b, c, g, h

Note: In Column 'Key' you will find recommendations found to foster female participation, each one is given a letter. In column 'Activity from the book' you will find the name of each exercise STEM-related or gender-related. The column 'Gender equality goals addressed' contains the letter to which the gender objectives of that specific item are associated.

## Appendix J

*Example of the use of third*



Note: This is an example of the graphic design concept *in the e-book* ‘use of thirds’, as the main element (the person) in the image is placed at the right third of the video. This is a screenshot from the editing of the video Module A, unit 2, exercise 6b.

## Appendix K

*Tools used for the creation of the e-book table.*

Digital tool's	Function
<b>name</b>	
Adobe	Design the e-book
illustrator	
Canva	Edit/create photos, add subtitles, add voices, remove background from images, download as vectors
Capcut	Edit video, add subtitles
Veed	Edit video, add subtitles
Recraft	Generate images
Leonardo.ai	Generate images
Adobe podcast enhance audio	
imgupscaler.	enhance images
com	
Flaticon	Take free images, icons and videos
Pexels	Take free images, icons, and videos
Pixabay	Take free images, icons, and videos

---

Maze creator    Create mazes

---

Word search    Create a word search

maker

---

## **Appendix L**

*e-Book final product*



8th grade

# UNIVERSAL XPLORERS

**Breaking Barriers,  
Expanding Horizons**



Universidad  
Industrial de  
Santander



Titulo original: Universal Xplorers: Breaking Barriers, Expanding Horizons

Autoría:

Daniela Gómez Grajales

Con el apoyo de:

Carolina Isabel Montes Perea

Máster en Derechos Humanos

Universidad Industrial de Santander

Escuela de lenguas

Primera edición, 2023

Bucaramanga, Colombia

E-book y recursos audiovisuales disponibles en línea: <https://drive.google.com/drive/folders/1tnjFv6-W02gDkB-lrxe-k0PbYFmDAe66Q?usp=sharing>

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# PRESENTACIÓN

En los últimos años, los campos STEM (ciencia, tecnología, ingeniería y matemáticas) han ganado reconocimiento por dar forma a la sociedad e impulsar la innovación (UNESCO, 2017). Sin embargo, existe una desigualdad de género, pues hay muchos más hombres que mujeres en estas importantes áreas a nivel mundial (UNESCO, 2017), nacional y en Santander (SNIES, 2022). Este fenómeno se debe, en parte, a que los estereotipos muestran estos campos como “masculinos”, lo que dificulta que las mujeres se interesen en ellos desde una edad temprana (UNESCO, 2017).

Esta cartilla, junto con su paquete de recursos audiovisuales, está destinada a profesores y alumnos de inglés de 8° en el contexto del aprendizaje y la enseñanza del inglés como segunda lengua, tiene como objetivo fomentar la igualdad de género en STEM rompiendo estereotipos y animando tanto a hombres como a mujeres a desarrollar su interés por estas disciplinas. Por ello, invitamos a los lectores a sumergirse en este material, descubrir la riqueza y potencial de los campos STEM y ser parte del cambio hacia una educación más equitativa e inclusiva para todos.

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## PRESENTATION

In recent years, STEM (Science, Technology, Engineering and Mathematics) fields have gained recognition for shaping society and driving innovation (UNESCO, 2017). However, there is gender inequality, as there are many more men than women in these important areas globally (UNESCO, 2017), nationally, and in Santander (SNIES, 2022). This phenomenon is due, in part, to stereotypes depicting these fields as “masculine”, which makes it difficult for women to become interested in them from an early age (UNESCO, 2017).

This primer, along with its audio-visual resource pack, is intended for 8th grade English teachers and students in the context of learning and teaching English as a second language, and aims to promote gender equality in STEM by breaking stereotypes and encouraging both men and women to develop their interest in these disciplines. We therefore invite readers to immerse themselves in this material, discover the richness and potential of the STEM fields and be part of the shift towards a more equitable and inclusive education for all.



# Dear English teachers

This document is the result of a literature review and needs analysis involving surveys of 8th-grade teachers and students in Santander. It identifies the importance of addressing this topic and the motivation to do so, while also providing methodological foundations for English language learning and teaching. We kindly encourage teachers to integrate this resource into their classes and incorporate it into their lesson plans. By complementing their existing teaching methods with this primer, educators can foster the cognitive and social growth of their students, offering them a comprehensive education that equips them for the future. Together, we can shape a brighter future where equal opportunities abound in these exciting fields.

## Material's foundations

This section lays out the key fundamental concepts and approaches that underpin the current teaching/learning material. These include transversality, critical pedagogy, its scope and sequence, and specific recommendations to foster gender equality.

### a. Core principles

- **Transversality:** It refers to the inclusion of cross-cutting themes in curricula, such as democratic participation and human rights, with the aim of fostering citizenship in order to develop comprehensive education (MEN, 2014; MEN, 2016). In this instance, the transversal theme is gender equality in STEM.
- **Critical pedagogy:** It is a teaching approach that aims to strengthen students' critical thinking skills and enhance social justice by empowering them to stand against injustices and challenge power systems (Giroux, 2011).

### b. Recommendations to foster gender equality

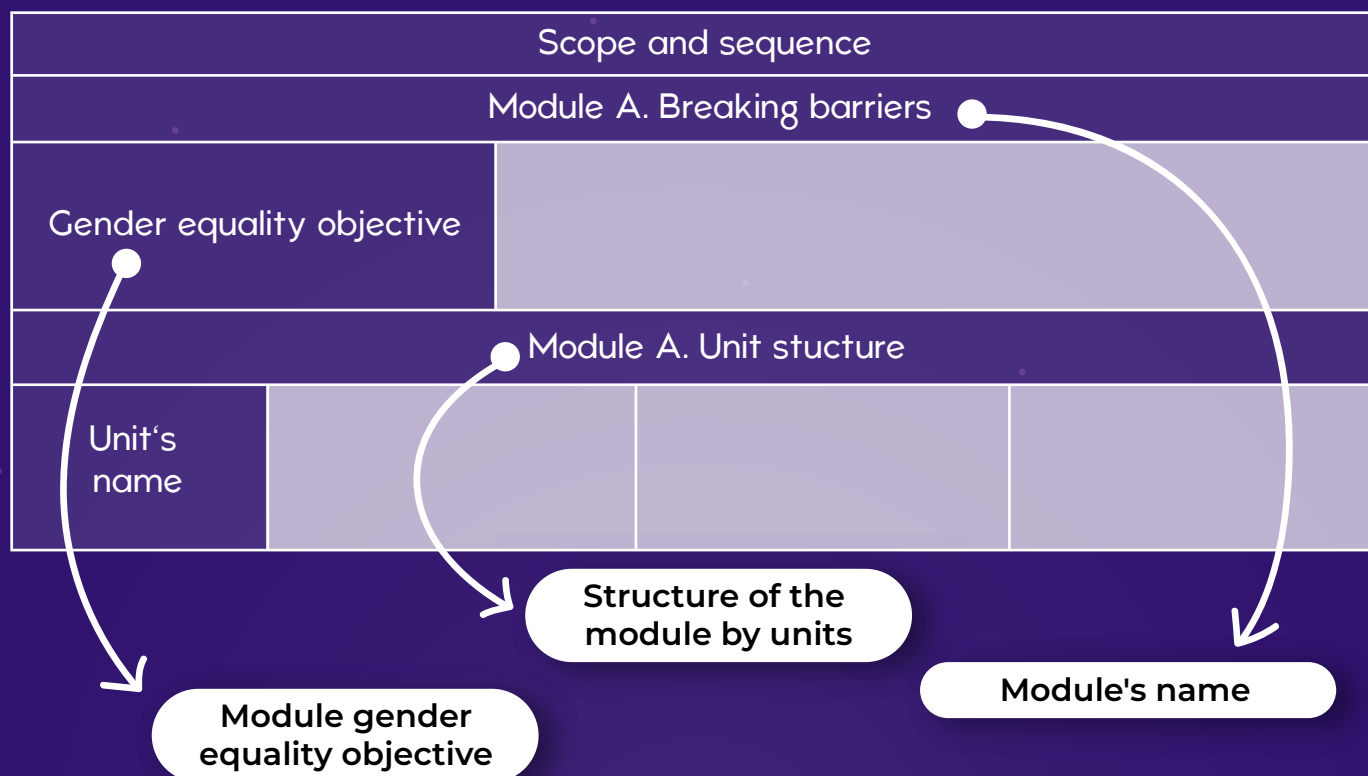
UNESCO (2017) and UN WOMEN (2020) provide recommendations for teachers to enhance gender equality in STEM. These include asking thought-provoking questions about gender roles, challenging stereotypes, showcasing female role models, using gender-neutral language, offering inclusive messages, involving girls in hands-on tasks, supporting learning outside the classroom, connecting girls to opportunities, and collaborating on regional initiatives.

### c. Scope and sequence

It refers to the document structure and order. This primer follows and adapts the 8th grade suggested curriculum by the National Ministry of Education (2016), as well as insights from Ramos, B. (2022) on designing ESL materials for Colombia, and students' preferences and needs in language learning content and activities proposed, according to the needs analysis. The scope and sequence are illustrated in the following figures below, encompassing the following dynamics:

- 2 modules (as indicated in the 'module's name' row) and a final reflection.
- Gender equality recommendations within the module, detailed in the 'Gender equality objective' row

- Each module consists of 2 to 3 units with specific learning objectives, grammatical content, and lexical content, as presented in the 'unit structure' section.



Finally, each unit is developed based on the ESA model for language teaching proposed by Harmer (1998) and explained by Yifan (2023) as a model involving three key elements: **ENGAGE**, **STUDY**, and **ACTIVATE**.

'**ENGAGE**' sparks students' interest and active participation through activities like games and stories. '**STUDY**' is where students learn language fundamentals with the teacher's guidance. '**ACTIVATE**' focuses on practical language use in real-life situations, improving communication skills through activities like role-playing and debates.

To understand the goals of upcoming activities, you can associate each part of the unit with its corresponding. ESA element using the following symbols



## Unit 1: Meet Mariana and Francisco



1. Find the hidden words in the word search

the following activities are intended to engage the student with the theme of the unit

# Scope and sequence



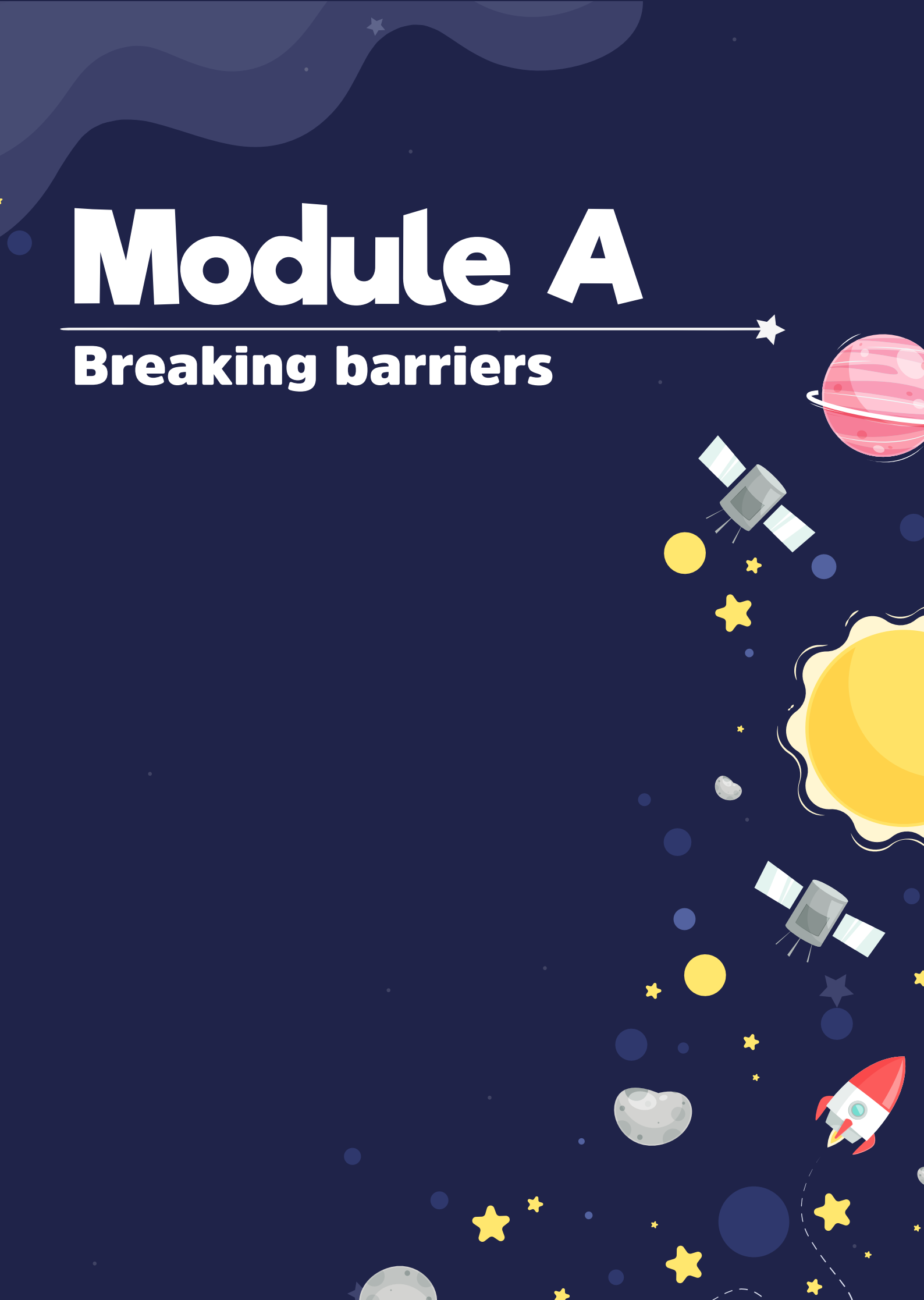
Scope and sequence			
Module A. Breaking barriers			
Gender equality objective		– Identifying and challenging gender stereotypes in STEM – Presenting gender diverse role models in STEM	
Module A. Unit structure			
Unit's name	Unit 1: Introduction	Unit 2: Role models	Unit 3: Pink for girls, blue for boys, is it always true?
Learning objective	By the end of this unit I will be able to present myself to a group by describing my interests, desires and talents.	By the end of this unit I will be able to describe human actions related to academic goals.	By the end of this unit I will be able to discuss good and bad practices around gender stereotypes in STEM.
Grammar	– Simple present tense [first person singular] – Verb to be [first person singular]	– Simple present tense [third person singular] – Verb to be [third person singular]	– Comparatives of superiority – Simple present tense
Lexis	STEM professions (part 1) Verbs about desires Self introduction phrases	STEM Fields STEM professions (part 2) Verbs about academic development Expressions to give opinions	– Toys – Adjectives related to gender stereotypes“

Scope and sequence		
Module B. Expanding horizons		
Gender equality objective	<ul style="list-style-type: none"><li>– Fostering STEM learning outside of the classroom</li><li>– Promoting regionally focused initiatives</li><li>– Connecting girls with scholarships, grants and mentoring programs.</li></ul>	
Module B. Unit structure		
Unit's name	Unit 1: STEM in Santander	Unit 2: How far do you want to go?
Learning objective	By the end of this unit I will be able to express facts and opinions.	By the end of this unit I will be able to express dreams and future plans.
Grammar	<ul style="list-style-type: none"><li>– Superlatives</li><li>– Present simple</li></ul>	<ul style="list-style-type: none"><li>– Future simple</li></ul>
Lexis	<ul style="list-style-type: none"><li>– Adjectives to describe things</li><li>– STEM places</li><li>– Verbs about places</li><li>– Phrases to show interest</li></ul>	<ul style="list-style-type: none"><li>– Scholarships and academic development expressions</li></ul>
Reflection	Summary and reflection of the primer	



# Module A

Breaking barriers



# UNIT 1: Meet Mariana and Francisco

E

1. Find the hidden words in the word search. Look at the example

## WORD SEARCH

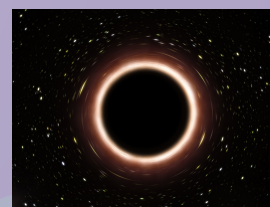
B	S	A	A	R	A	A	N	A	S	R	T	T	S
S	U	E	H	D	A	N	P	L	S	A	S	O	C
L	A	C	L	I	A	S	T	S	L	A	T	Y	S
C	A	G	A	O	N	S	T	S	R	T	R	O	I
P	D	A	M	R	H	S	A	R	S	A	A	E	C
A	L	L	K	A	A	K	E	I	O	A	O	M	I
H	O	A	L	I	R	M	C	A	U	N	A	I	P
E	S	X	A	A	I	A	A	S	T	A	R	S	
T	R	I	L	E	S	A	A	N	L	O	U	U	Y
S	A	E	A	Y	M	L	R	N	G	B	A	A	T
T	E	S	H	H	I	A	K	L	A	A	C	E	A
C	Y	P	U	T	M	A	L	D	S	S	L	A	P
M	S	P	A	C	E	U	E	E	U	P	K	P	T
A	S	T	E	R	O	I	D	S	A	O	P	U	I

- ☐ Asteroids
- ☐ Physicist
- ☐ Astronaut
- ☐ Bucaramanga
- ☐ Space
- ☐ Stars
- ☐ Mariana
- ☐ Black Holes
- ☐ Years Old
- ☐ Galaxies

2. Look at the words from the word search, then fill in the blank space with the matching word for each picture.

Look at the example

### Exercise 0



Black hole



A \_\_\_\_\_



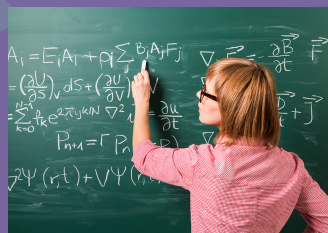
B \_\_\_\_\_



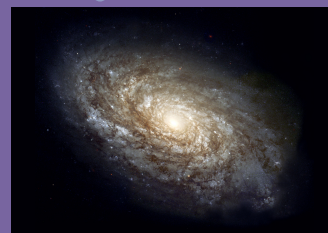
C \_\_\_\_\_



D \_\_\_\_\_



E \_\_\_\_\_



F \_\_\_\_\_





3. Read the text and identify:

A. Who are the speakers?

\_\_\_\_\_

B. What do they have in common?

\_\_\_\_\_

Hello! I am Mariana  
I am 14 years old  
I am from Santander  
I live in San Alonso  
and I love the space!  
I love the the stars and the galaxies

I want to be an astronaut one day!  
to see them with my own eyes.



Hi Mariana, I am Francisco  
I am 13 years old  
I am also from Santander  
but I live in Real de Minas  
The space is awesome!  
I like the big asteroids, and the black holes.  
They are so mysterious

I would like to be a physicist one day,  
to study how they work  
or an astronaut, to watch them in reality



4. Check if these sentences are true (T) or false (F) using the text. If it's false, write the part from the text that proves it.

Exercise 0

The girl's name is Alejandra F  
"I am Mariana"

A. The boy's name is Francisco \_\_\_\_\_

\_\_\_\_\_

B. Mariana is 13 years old \_\_\_\_\_

\_\_\_\_\_

C. Francisco wants to be a chemist \_\_\_\_\_

\_\_\_\_\_



# Focus language

5. Read Mariana's self-introduction in the text (point #3), then complete the mind map with the expressions in the box.



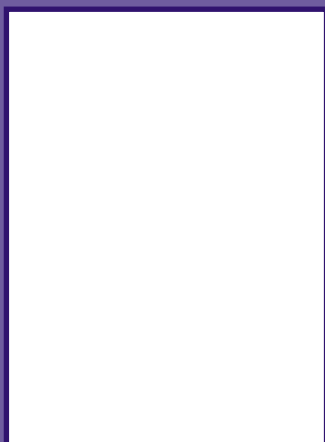
6. Mariana and Francisco want to know about you. In order to do it follow the instructions

**A.** Write your self-introduction. Remember to include your name, age, where you are from, where you live, and one thing you like.

Follow Mariana and Francisco's example (point #3)

**B.** Draw yourself

**C.** In partners, share your answers



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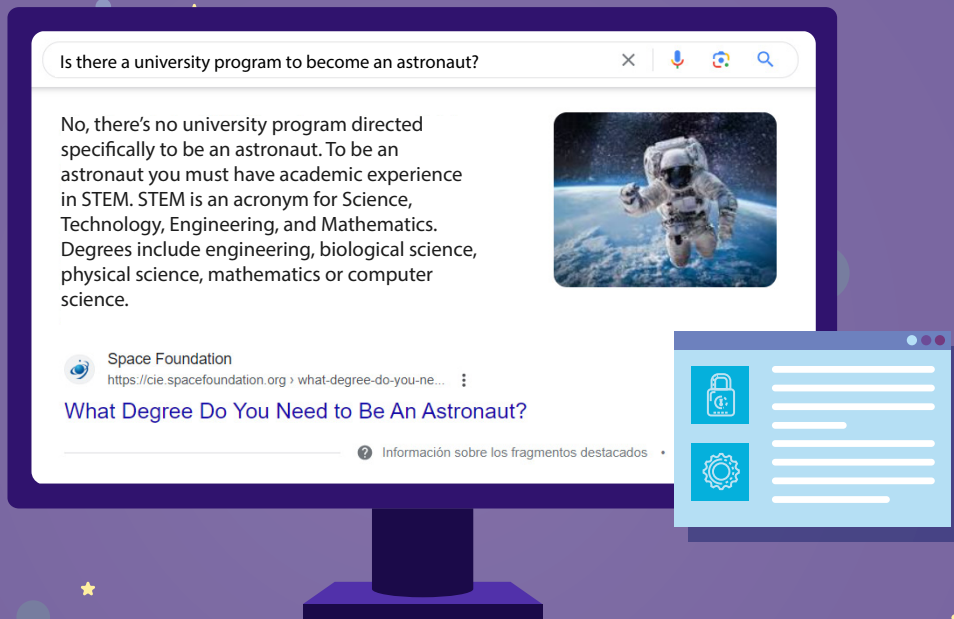
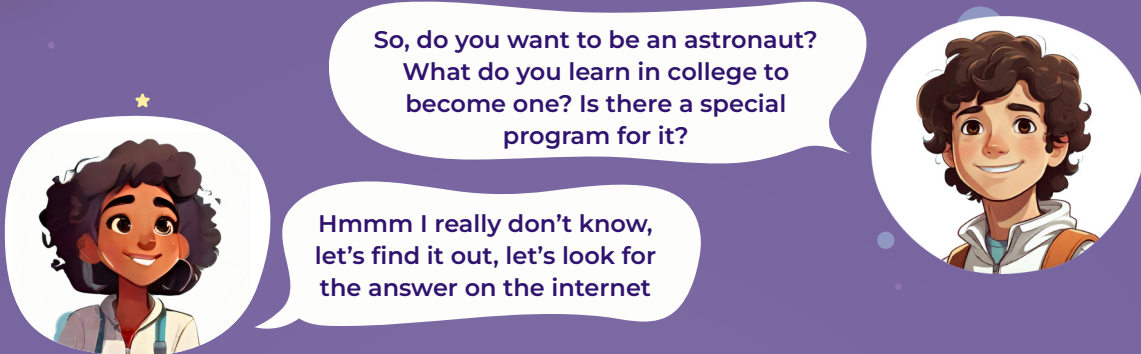
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# UNIT 2 : Role models

1. Mariana wants to be an astronaut, and she has questions about how to become one. Read the text carefully, then complete point 2.



2. Mariana and Francisco find out there's no specific university program to be an astronaut. Instead, they must study a STEM discipline. Help them understand what STEM is and how they can get to space.

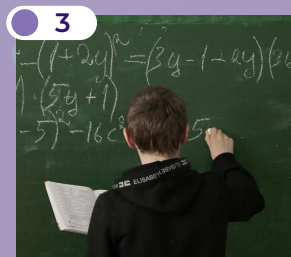
A. Match the images with the STEM discipline. Look at the example below

A. Science

B. Technology

C. Engineering

D. Mathematics



B. Read the description below and figure out which area of STEM it's talking about. Look at the example.

### 0. Science



\_\_\_ A. People in this field design and build things like bridges, cars, and buildings. They use math and science to solve problems and create new stuff. If you want to be one, you can study civil engineering, mechanical engineering, or electrical engineering.

### 1. Technology



\_\_\_ B. It is all about numbers, and patterns. It helps us solve problems, count things, and understand how things work. You can study statistics to learn about it

### 2. Engineering



0 C. It is all about discovering and understanding the world around us. People in this field study living things like animals and plants, as well as non-living things like rocks and stars. Some programs include biology, chemistry, and physics.

### 3. Mathematics



\_\_\_ D. It involves using tools and machines to make our lives easier. It's like your computer, phone, and all the cool gadgets you use. You can learn about it in computer science or IT (Information Technology) programs.

3. Complete the list of famous scientists with your own knowledge. Look at the example



## SCIENTISTS

Isaac Newton


4. Now, in pairs, compare your answers

A. Which scientists you didn't know?

\_\_\_\_\_

B. How many of your scientists were women?

\_\_\_\_\_

Different studies found that, in general, people associate STEM figures (such as scientists) with male figures such as Isaac Newton among others. This happens despite there being many important women in STEM. This phenomenon is so evident and serious that the UN (United Nations) created the 'International Women in Science Day' in which we commemorate and encourage women's work in STEM.

5. Look at the names and pictures in the cards, then match the STEM woman with her achievement. Look at the example



A. Katherine Johnson



B. Cecilia Payne



C. Mary Kenneth



D. Rosalind Franklin

1. She is an astronomer and astrophysicist, she is curious about stars and novae and discover that the stars are composed of 99% hydrogen and helium.

2. She is a nun, a mathematician a pioneer of computer science. She participates in the creation of the basic programming language

3. She is a chemist and X-Ray crystallographer. She is intelligent and she discovers the structure of DNA

0. She is a pioneer in space science and computing. She is brave. She calculates the trajectory for the Apolo 11 flight to the moon.

6. Let's find out about STEM and female role models in STEM! You will watch two videos, from these complete exercises A and B

A. First, watch the introduction (video 1) and answer the questions:



1. Why is STEM important?

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2. What are some professions in STEM?

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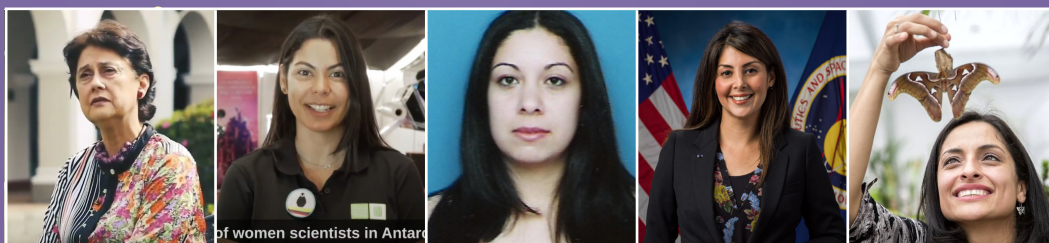
3. What is your favorite profession in STEM?

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B. Then, watch the role models video (video 2) and complete the table below. Look at the examples



Name	She is Debora Tejada			She is Diana Trujillo	
City		She is from Bucaramanga		She is from Cali	
Profession			She is a professor at Mechanical Engineer School at Universidad Industrial de Santander		She is leading Colombian butterfly scientist and biologist
Qualities	She is disciplined		She is organized		





# Focus language

7. Select your favorite Colombian STEM role model from the table and complete the following mind map with her information. Use the information in the table (point #6). Look at the example below

**Name**  
Paola Tello

**City**  
From Bucaramanga

**Quality**  
Energetic

**Profession**  
She is a psysicist

**She is**

**Note:** in the present affirmative with "she" and "he" we add and "s" at the end of the verb

- I work
- He works
- She works

## YOUR TURN

**City**

**Name**

**Quality**

**Profession**

**She/He is**

8. Mariana and Francisco got inspired by the role models from the video. Listen to the conversation and match the characteristics they want to be. Each name will go with different characteristics, look at the example.



A. Mariana

B. Francisco

0. Aerospace engineer

1. Energetic

2. Positive

3. Paola Tello

4. Diana Trujillo

5. Physicist



9. You are going to do the pop-up 'role model' figure. In order to do this, follow points a, b, and c

A. Read the instructions carefully

## INSTRUCTIONS

### Time Required

About 90 minutes  
in addition to  
research time

### Materials

1 Person Pop-Up Template  
1 Scissors  
1 Tape

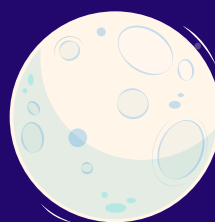
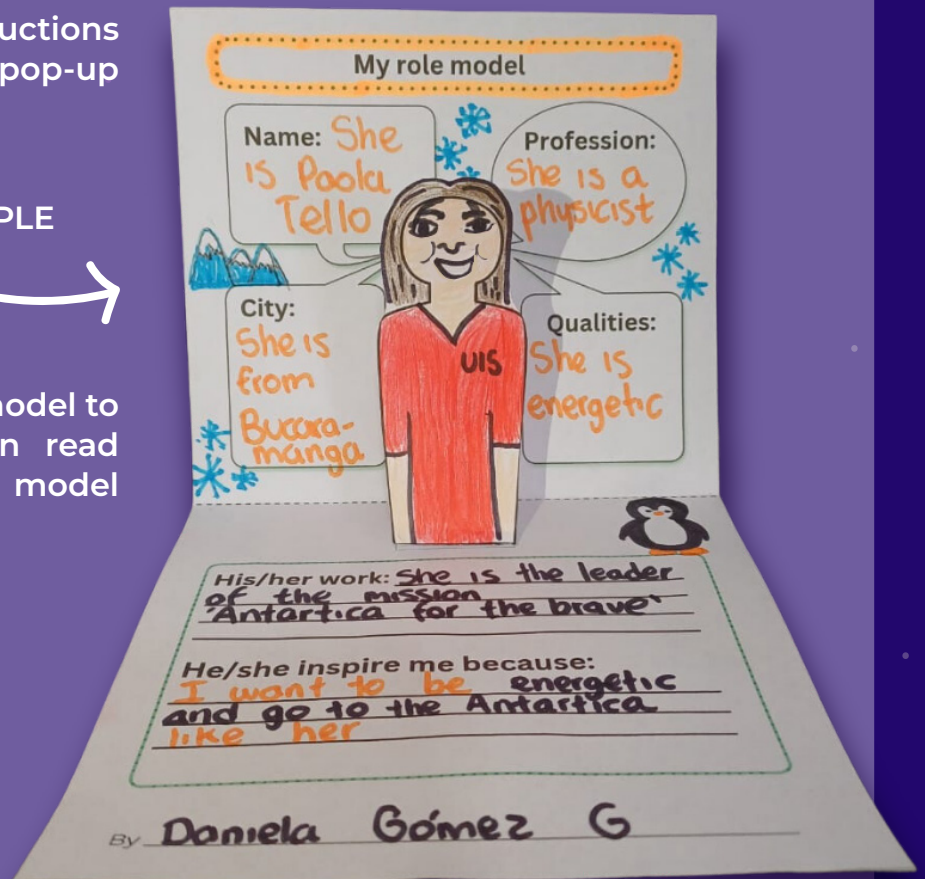
### Steps

1. Select a famous STEM person, it can be of any gender
2. Research about him/her, including her/his name, city of birth, profession, qualities, work, and why he or she inspires you
3. Cut out a large rectangle and two smaller pieces, as indicated.
4. Fold a large rectangle 90 degrees.
5. Fold the hinge as indicated.
6. Attach the hinge to the large rectangle with tape.
7. Use the pop-up piece to create the person and tape it to the hinge.
8. Fold the rectangle down. Ensure that internal pieces fold properly. Crease the fold.
9. Fill in the important information.

- B. Follow the instructions and make your pop-up 'role model figure'

EXAMPLE

- C. Present your role model to the class. You can read your pop-up 'role model figure'



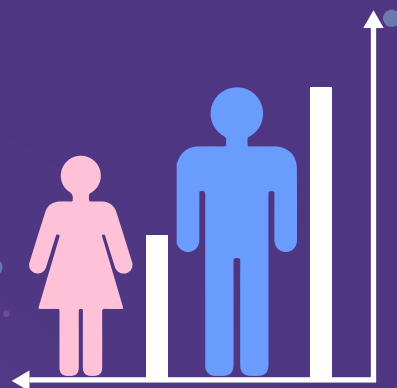
# UNIT 3 : Pink for girls, blue for boys, is it true?

## DID YOU KNOW?

### In Bucaramanga

Women represent only 36% of STEM students

While men represent the 64%



1. Mariana and Francisco are debating the question: "If women can also succeed in STEM, why do more men end up in that field?"

- A. What do you believe? Think about it and write down your answer. You can start with phrases like "I think", "I consider", "In my opinion". Remember to express yourself politely.

Look at the example

In my opinion, there are more men than women in STEM fields because it is harder for women to enter this field.

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- B. Share your answers with your classmates and have a fun chat. Be sure to talk kindly and be respectful with each other.

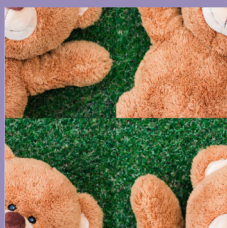
- C. Listen to Mariana and Francisco's ideas.





2. The images below are toys that Marina and Francisco mentioned. They are mixed up. Identify the original picture and circle your answer. Look at the example

A.



1. Car
2. Teddy Bear
3. Doll
4. Blocks

C.



1. Doll
2. Blocks
3. Ball
4. Stroller

B.



1. Doll
2. Boat
3. Ball
4. Blocks

D.



1. Doll
2. Tools
3. Stroller
4. Car

3. Mariana and Francisco want to know about your experience. In order to do this, complete points a and b.

A . Please read the survey and answer "Yes, I did" or "No, I didn't" by writing an "X" in the corresponding square. Look at the example.

Question	Response	
	Yes, I did	No, I didn't
1. Did you play with toys when you were a child?	X	
2. Did you play with dolls as a child?		
3. Did you own a teddy bear or stuffed animal?		
4. Did you play with a stroller?		
5. Did you own a ball?		
6. Did you play with cars?		
7. Did you play with a robot or any other technological device that was a toy?		
8. Did you own a tool set?		
9. Do you consider yourself good at mathematic or science or technology?		
10. Do you find STEM interesting?		

B . Choose a partner, if you're a girl, select a boy, and vice versa. Then, compare your answers, which are different?



4. Mariana and Francisco found the answer to the question "If women can also succeed in STEM, why do more men end up in that field?" and they want you to know. In order to do this, complete exercises a, b, and

A. Read the text carefully with your partner and **highlight** all the toys you find







In Santander, the majority of STEM students are men, with only 36% being women. This gender gap is connected to gender stereotypes, which dictate how people think girls and boys should behave and what they should like. One way these stereotypes influence lives is through the toys children play with, which can shape their future interests and abilities in STEM fields.



For example, toys considered as "girls' toys", are prettier and smaller than "boys' toys", which makes girls feel that being pretty and delicate is very important. One example of this is fashion dolls like Barbies and Bratz. In contrast, boys' toys are more adventurous and more energetic than girls' toys, which encourages them to be curious about the world and plan exciting things. This is the case with cars, rockets, and toy telescopes. In the same way, some girls' toys like teddy bears, baby dolls, and strollers are more caregiving than boys' toys, meaning those toys encourage girls to take care, give love, and help others. On the other hand, boys' toys like blocks or tool sets are more strategic than girls' toys.

This early influence can sometimes make girls think STEM subjects are just for boys, and they might find science less interesting or more challenging than boys do. To change this, we should let all kids play with various toys and discover what they like. Girls can be just as curious and excited about STEM as boys. STEM isn't just for boys, and it's not less interesting or more challenging than they might think.

**B .** Complete the blank spaces in the table with the toys you found in point 4A. First, determine if the toy is typically associated with women or men (column A or B). Next, identify the action linked to each toy and write it down in that row. Look at the example:

 <p>Column A. Toys associated with women</p>		 <p>Column B. Toys associated with men</p>	
<p>★ To be pretty To be delicate ★</p> 	<p>Exercise 0. Fashion dolls</p>	<p>To be adventurous, to be energetic ★</p> 	<p>D. _____ E. _____ F. _____</p>
<p>To take care, to give love, to help others</p> 	<p>A. _____ B. _____ C. _____</p>	<p>To be strategic</p> 	<p>G. _____ H. _____</p>

**C .** Complete the following sentences using the text in point 4A. Look at the example

Exercise 0

Boys' toys are more adventurous than girls' toys

- Boys' toys are more adventurous and \_\_\_\_\_ than girls' toys
- Some girls' toys like teddy bears, baby dolls, and strollers are \_\_\_\_\_ than boys' toys.
- For example, toys considered as "girls' toys", are \_\_\_\_\_ and smaller than "boys' toys"
- Boys' toys like blocks or tool sets \_\_\_\_\_ than girls' toys.
- For example, toys considered as "girls' toys", are prettier and \_\_\_\_\_ than "boys' toys"

# Focus language

5. Read the following table. Then complete exercises a and b. If you need extra help don't hesitate to ask your teacher

**A .** Correct your previous answers in the last point (4c) following the rules of the table.




**B .** Classify the phrases from point 4c in the correct row of the table. Look at the example

## Comparatives of superiority

Usage: we use comparatives of superiority when we want to compare two things and show that one has a higher degree of a particular attribute(adjective) than the other.

Example: Boy's toys are more adventurous than girl's toys



Adjectives' length 	Rule	Examples
<p>Adjectives whose number of syllables is long</p>  <p>Adventurous Ad - ven - tur - ous</p>	<p>verb to be ( simple present form) + more + adjective + than</p>	<p>Example: Boys' toys are more adventurous than girls' toys.</p> <p>A • _____</p> <p>_____</p> <p>B • _____</p> <p>_____</p> <p>C • _____</p> <p>_____</p>
<p>Adjectives whose number of syllables is short</p>  <p>Pretty Pre - tty</p>	<p>verb to be (simple present form) + adjective + er</p>	<p>Example: toys consider "girls' toys", are prettier and smaller than "boys' toys"</p> <p>D • _____</p> <p>_____</p> <p>E • _____</p> <p>_____</p>

6. Complete the following phrases with the images and the verbs in brackets. Look at the example

Exercise 0

Fashion dolls are smaller (small) than toy telescopes.



A. \_\_\_\_\_ dolls are \_\_\_\_\_ (pretty) \_\_\_\_\_.



B. \_\_\_\_\_ dolls are \_\_\_\_\_ (caregiving) \_\_\_\_\_.



C. \_\_\_\_\_ are \_\_\_\_\_ (adventurous) \_\_\_\_\_.







7. Read a comic about a young girl's likes and interests, then complete points a and b



**A .** What would have happened if the girl had not been given the teddy bear?

Reread the comic and create a different ending for the story, using at least 1 comparative structure.

1. What does the girl see in the first picture?

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2. Who gives the little girl a doll?

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3. How does the little girl feel about math at the story's beginning?

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4. How does the little girl feel about math at the end of the story?

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**B •** What would have happened if the girl had not been given the teddy bear?

Reread the comic and create a different ending for the story, using at least 1 comparative structure.

Scene 1

Scene 2

Scene 3

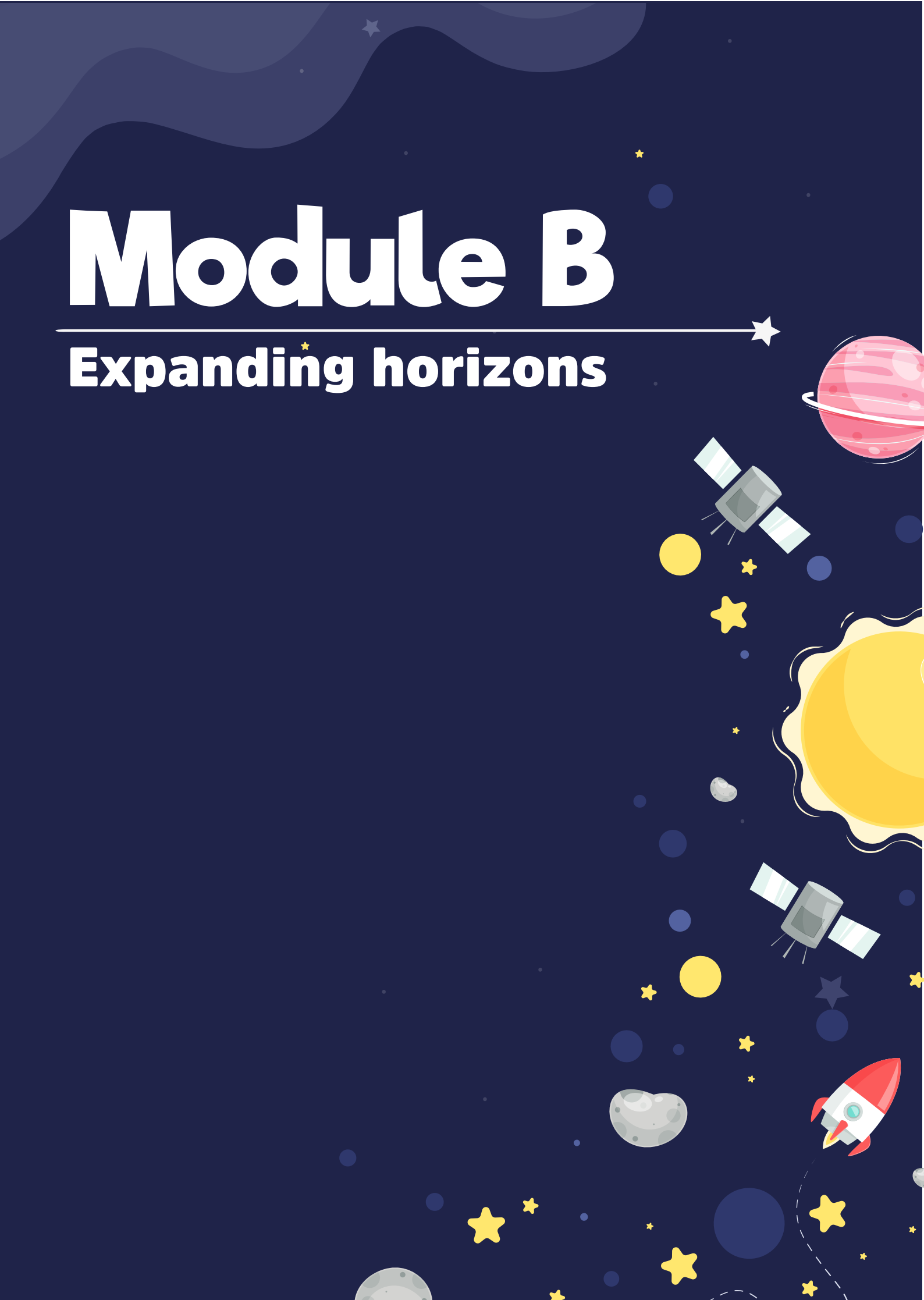
Scene 4

Scene 5

# Module B

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## Expanding horizons





# UNIT 1: Where does STEM occurs in Santander?

1. You find an astronomer, a biologist, and a geologist, they are lost and they can't find their way to the places where they work

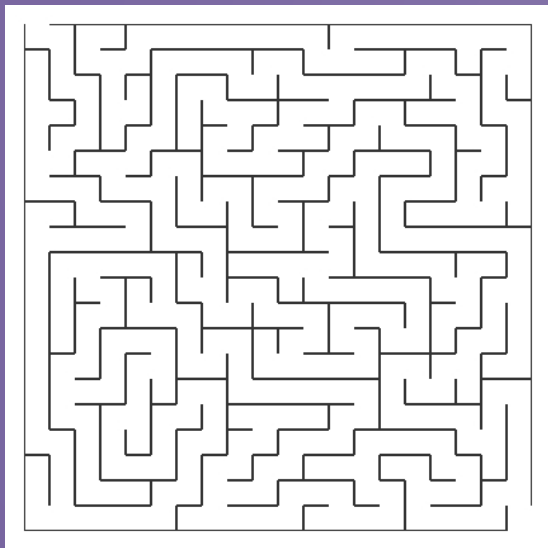
**A •** Help people with different professions to reach the place where they work!

Complete the mazes. Look at the example.



Maze 1

Geologist

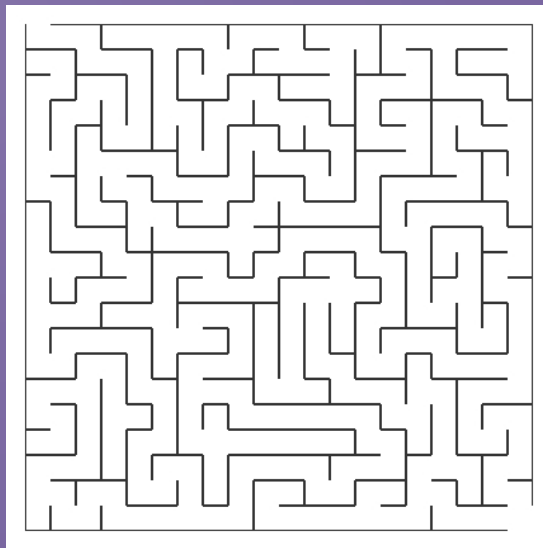


Mines



Maze 2

Biologist



Jungle

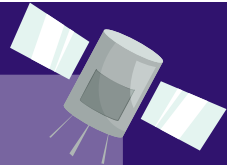


**B .** Complete the phrases with the corresponding place. Look at the example

Exercise 0

An astronomer works at the observatory

1. The geologist works at \_\_\_\_\_
2. The biologist works at \_\_\_\_\_



## 2. Galactic General Knowledge Quiz: Test Your Space Knowledge!

Answer the following questions related to space. Circle the correct option for you in each question. Look at the example

Exercise 0: The Brightest Star: Which is the brightest star in the night sky?

- ☐ 1. Polaris
- ☐ 2. Betelgeuse
- ☒ 3. Sirius

A . The Hottest Planet: Even though it's not the closest planet to the Sun, which planet is considered the hottest in our solar system?

- ☒ 1. Venus
- ☐ 2. Mars
- ☐ 3. Mercury

B . The Biggest Planet: Which is the biggest planet in our solar system?

- ☐ 1. Earth
- ☐ 2. Neptune
- ☐ 3. Jupiter

C . The Most Famous Meteor Shower: Which meteor shower is considered the most famous and can be best observed in August?

- ☐ 1. Orionids
- ☐ 2. Perseids
- ☐ 3. Geminids

D . The Smallest Planet What is the smallest planet in our solar system?

- ☐ 1. Earth
- ☐ 2. Venus
- ☐ 3. Mercury

3. Examine the images and arrange the letters to create the word that corresponds to each picture. Refer to the bolded words in point #1 for guidance. Look at the example.

Exercise 0

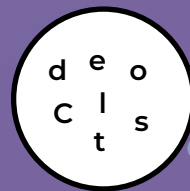


Brightest

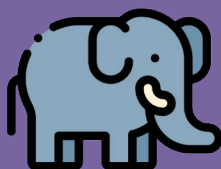
A .



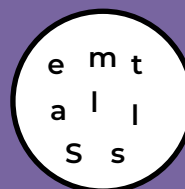
B .



C .



D .





4. Look at the following statements and decide if you agree or disagree with them. Justify your answer using the following table as a guide. Look at the example

I really like STEM,  
but, are there places  
to learn about, STEM  
in Bucaramanga?



Phrases for  
Agreeing

- I agree because...
- I think it's true because...
- I think so too because...

Phrases for  
Disagreeing

- I respectfully disagree because...
- I see it differently because...
- I'm not sure about that...

Justifying

- In my opinion...
- From my perspective...
- Based on what I know...

### Statements

### Justification

1. Bucaramanga has good  
places to do science



- I agree because, for example,  
UIS has spaces to do STEM

2. In Bucaramanga there are  
places to learn about the space



3. In Bucaramanga there are  
places to learn about biology







No, I don't think there are many places to do and learn about STEM in Bucaramanga

I disagree because I think there are some places, however, the majority of us don't know about them



5. You will learn about some places to enjoy and discover STEM in Bucaramanga. Watch the video and answer points a,b and c

A . Look at the following images and write the name of the elements from the video.



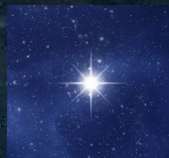
Galaxy



A.



B.



C.



D.



E.



G.



F.



H.

**B . Read the questions and answer according to the video and on your own opinion. Look at the example:**

**EXERCISE 0.** What is the most interesting thing about the planetarium?

In my opinion, the most interesting thing is that there is a professor who explains the space to everyone

1. How do you feel about the fact that the planetarium is open to everyone?

---

---

2. Do you like nature and animals? Would you like to visit the Natural History Museum in Bucaramanga?

---

---

3. What is the rarest animal at the Natural History Museum?

---

---

**C . Read the following clues and guess which place or element from the video is being described. Then, draw it.**

Look at the example

**CLUE**

A. It is a place where you can see galaxies on the biggest screen ever, like the best movie theater in the universe

**CLUE**

C. It is an animal and it is the best swimmer in the world

**CLUE**

0. It is the university where you can find the planetarium and the Natural History Museum



**CLUE**

B. They are the tiniest group of animals and they usually live on the ground

**CLUE**

D. It is the best place to learn about biology and animals



# Focus language

6. Complete the phrases with the information on the tickets. Look at the example



## Exercise 0

Step into the biggest cosmic adventure at the Planetarium UIS

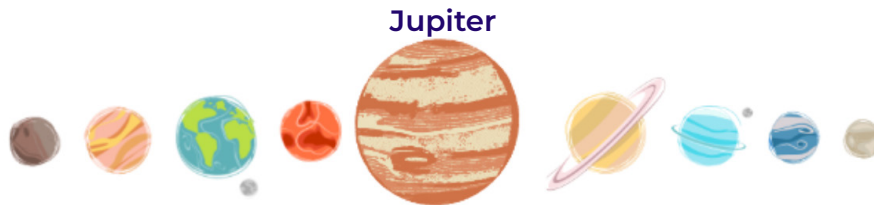
1. You'll witness \_\_\_\_\_ stars
2. You'll witness stars and \_\_\_\_\_ planets.
3. Get ready for an adventure at \_\_\_\_\_ museum in Bucaramanga!
4. Witness \_\_\_\_\_ ... creatures
5. Witness the strangest and \_\_\_\_\_ creatures

7. Read the following table. Then complete exercises a and b. If you need extra help don't hesitate to call your teacher




- A . Correct your previous answers in the last point (4c) following the rules of the table.
- B . Classify the phrases from point 4c in the correct row of the table. Look at the example

## Superlatives of superiority

Usage: we use superlatives of superiority when making comparisons of three or more people or things and one of them is the highest degree of a characteristic.



Example: Jupiter is the biggest planet in the solar system.

Adjectives' length 	Rule	Examples
<p>Adjectives whose number of syllables is long</p>  <p>Interesting in - te - res - ting</p>	The + most + adjective	<p>Example: You'll witness ... and <u>the most interesting</u> planets.</p> <p>A • _____</p> <p>_____</p>
<p>Adjectives whose number of syllables is short</p>  <p>big big</p>	The + adjective + est	<p>B. Example: Step into <u>the biggest</u> cosmic adventure at the Planetarium UIS</p> <p>C • _____</p> <p>_____</p> <p>D • _____</p> <p>_____</p> <p>E • _____</p> <p>_____</p> <p>F • _____</p> <p>_____</p>



8. Look at the pair of sentences and circle the one that is correct. The sentence can be either a comparative or a superlative. Look at the example

Exercise 0

The Sun is the brightest star in the Solar System

The Sun is brightest star in the Solar System

- A. Venus is the most hot planet in the Solar System  
Venus is the hottest planet in the Solar System
- B. Neptune is the coldest planet in the Solar System.  
Neptune is the colder planet in the Solar System.
- C. Mercury is more small planet in the Solar System  
Mercury is the smallest planet in the Solar System
- D. Jupiter is the more old planet than the Solar System  
Jupiter is the oldest planet in the Solar System



9 A . Pick a place in Santander to learn about STEM, such as the planetarium or the history museum.



B . Study the example below to take into account what items your ticket should include.

A short description of what people will do at the event. Include at least 2 superlatives

Name of the place

Address

Date

**PLANETARIUM**

Step into the biggest cosmic adventure at the Planetarium UIS, where you'll witness the brightest stars and the most interesting planets

UNIVERSIDAD INDUSTRIAL DE SANTANDER

PUBLIC TICKET

ONE TICKET FOR ONE PERSON.

**\$ 8000**

March  
**25**  
2023

**SPACE FESTIVAL**

Ticket Number:  
1234567890



- C.** In the template, draw a sketch of your ticket with the features mentioned above. Use your favorite colors and images. Once your sketch is ready, check with your teacher to see how you're doing, and then create the final version on a sheet of bond paper.



- D.** In the box provided, each student should write a short opinion about the statement, "I would love to go to this place." You can use the expressions from exercise 4.

Look at the example

Exercise 0

"I would love to go to this place"

- I agree because the space is fun and I want to go to learn about the space.

---

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- E.** Present your final ticket and share your opinions about it with the class.

# UNIT 2 : How far do you want to go?

E

1. Mariana and Francisco just came from the planetarium. Read the following events and organize them chronologically from 1 to 5 according to the audio.

Look at the example.



0. 4 Mariana doubts she can achieve her dream because she doesn't have a lot of money to study and she thinks there may be little opportunities because there are little women in STEM

1. \_\_\_\_ Mariana says that the planetarium was amazing and that she wants to be an astronaut

2. \_\_\_\_ Francisco says the planetarium was wonderful and that he wants to be an astronaut

3. \_\_\_\_ Mariana and Francisco came from the planetarium

4. \_\_\_\_ Francisco mentions an advertisement

2. Look at the advertisement and answer exercises a and b

A. Complete the following crossword with the words from the text. Look at the example

## Across

2. A financial award given to a student to support their education, often based on academic or other achievements.

4. If you take a \_\_\_\_\_ you may get the scholarship

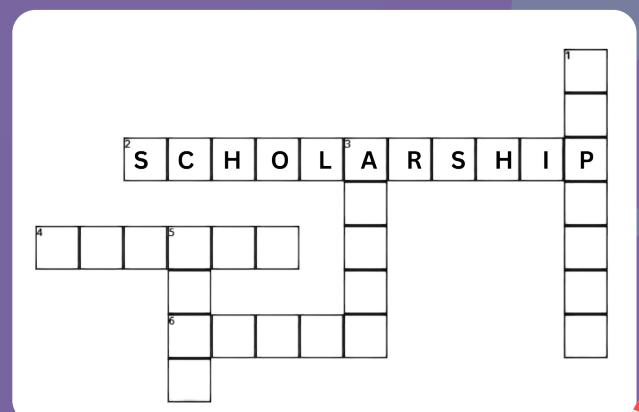
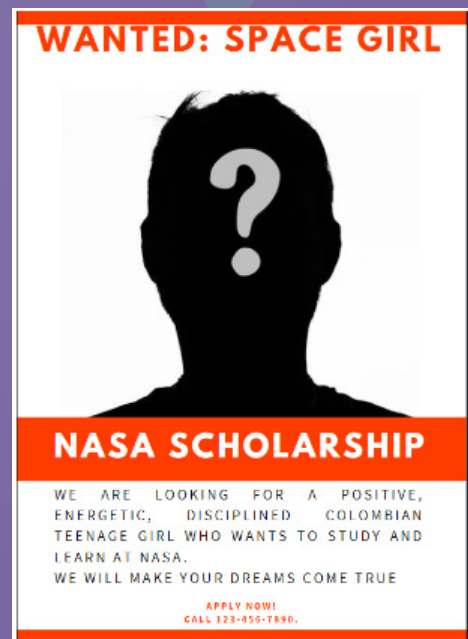
6. The act of dedicating time and effort to acquiring knowledge or mastering a subject through reading, classes, or practice.

## Down

1. When someone helps you with something

3. You should \_\_\_\_\_ to get a scholarship to enter to the best university!

5. An organization that helps scientists and astronauts explore space and learn cool things about the universe.



**B.** Check if these sentences are true (T) or false (F) using the advertisement. If it's false, write the part from the text that proves it.

Look at the example

Exercise 0

Someone is looking for a cat F

"We are looking for a ... colombian teenager girl"

1. They are looking for a negative person \_\_\_\_\_

2. They are looking for an adult woman \_\_\_\_\_

3. They are looking at this person for no reason \_\_\_\_\_

4. The qualities that they are looking for in a Colombian teenage girl are : to want to go to NASA, to be disciplined, positive and energetic

**C.** Read the statements and circle "yes" if you agree with the statement, and "no" if you don't. Discuss with your class each item.

Exercise 0

The advertisement draws my attention

Because it sounds interesting

~~YES~~

NO

1. I have the qualities of the person they are describing.

YES

NO

2. I would like to go to NASA.

YES

NO

3. I think it is not possible that they take a teenage colombian girl to the space.

YES

NO



### 3. Read the news and complete point a

Bucaramanga, Santander

## THE NEWSPAPER LINE

www.reallygreatsite.com

### GREAT NEWS



Foto tomada de: Fundación She is

## COLOMBIAN GIRLS WILL GO TO NASA

**35 GIRLS FROM DIFFICULT AREAS WILL VISIT NASA'S SPACE CENTER TO LEARN ABOUT THE UNIVERSE IN THE UNITED STATES.**

80% of the space industry workers are men and Only 20% are women, which shows that we need more women working as astronauts, scientists, and engineers. For this reason, a scholarship called "She is astronaut" will send 35 Colombian girls to NASA's Space Center.



Foto tomada de: Fundación She is

For 5 months the girls have been taking classes online to learn about space, STEM, and gender equality. But this weekend will be different, they won't stay at home in their departments in Colombia. Instead, they will travel to Houston, Texas to keep learning. This time they won't just listen to lectures; they will meet astronauts and women engineers, and they will play with robots and machines.

This program will help them develop their capacities, appreciate their intelligence and learn. They will use their new knowledge to help other girls and women in their Colombian's regions.

### A . Match the sentence with the picture



#### Exercise 0

D They will use their new knowledge to help other girls and women in their Colombian's regions.

- \_\_\_ They won't stay at home in their departments in Colombia.
- \_\_\_ They will meet astronauts.
- \_\_\_ They will play with robots and machines
- \_\_\_ They won't just listen to lectures online
- \_\_\_ They will see real rockets



# Focus language

**B .** Classify your answers to the last point (4c) writing them in the correct row of the following table. Look at the examples.

Future Simple	
We can use it to predict the future or for future plans	
Affirmation	Negation
Subjet + will + infinitive verb	Subjet + won't + infinitive verb
Examples: O. They <u>will meet</u> astronauts A. They _____ with robots and machines	Examples: B. They _____ at home in their departments in Colombia C. They _____ listen to lectures online

**C .** Watch the video about the girls who will go to space. Then, complete the following sentences with the correct form of future simple.



Vídeo tomado de EL TIEMPO  
'35 niñas colombianas viajarán al Space Center invitadas por la Nasa | El Tiempo

Look at the example

## Exercise 0

- 35 girls will travel (travel) to Houston.

1. These girls \_\_\_\_\_ (visit) the NASA Space center
2. They \_\_\_\_\_ (access) to STEM education
3. Sofía \_\_\_\_\_ (inspire) other girls to participate in STEM
4. In the future, more girls \_\_\_\_\_ (get) the scholarship
5. Estefanía \_\_\_\_\_ (apply) her knowledge in our country



4. Mariana has a plan to be an astronaut. Read her presentation and complete Exercise A

My plan		
<p><b>I am... (self-introduction)</b></p> <p>Hello! I am Mariana I am 14 years old I am from Santander I live in San Alonso <i>and I love the space!</i> <i>I love the stars</i> <i>and the galaxies</i></p>		<p><b>I admire... (role model)</b></p> <p>Diana Trujillo, <b>because</b> she is from Cali, she is an engineer and she is disciplined</p>
<p><b>I am... (qualities)</b></p> <p>Energetic, disciplined and enthusiastic</p>	<p><b>I will ...</b> I will be an astronaut.</p> <p><b>How?</b> First, I will apply to the 'She is an astronaut' program. Then I will study for an engineering bachelor at Universidad Industrial de Santander. I will study there with the "Generación E" scholarship.</p> <p>Then I will apply to be an astronaut</p>	<p>Mariana Gómez</p> <p>8-3</p>

**A • Now it is your turn to present your plan!** Follow the instructions below



1. Cut down the template along the solid lines



2. Fold the paper for the dotted line

3. At the left of the template, write down your self introduction, along with your qualities.

4. At the right of the template, write down about the STEM role model you admire

5. Imagine you want to pursue a STEM career. In the middle of the template, choose the STEM program you liked the most and write what it is and **how will you achieve it.**

6. Present it to the class.





# Reflection



We have learnt about gender equality in STEM. Let's reflect on our pathway, you can answer in Spanish

1. What is STEM and why is it important?

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2. What programs and professions are involved in STEM?

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3. What is a challenge in STEM in terms of gender?

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4. Why are more men than woman in STEM?

---

---

5. What can you do to promote gender equality in STEM?

---

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# Answer key module A

## Unit 1

### Exercise 1



### Exercise 2

0. Black hole

A. Stars

B. Space

C. Astronaut

D. Asteroid

E. Physicist

F. Galaxy

### Exercise 3

A. The speakers are Mariana and Francisco

B. They have in common that they live in Bucaramanga, Santander, and they want to be astronauts

### Exercise 4

0. F - "I am Mariana"

A. T

B. T

C. F- "I want to be a physicist one day ... or an astronaut"

### Exercise 5

A. I am - age: 13 years old

B. I am - city: Bucaramanga

C. I am - name: Mariana



## Unit 2

### Exercise 2A

A-0

B-1

C-2

D-3

### Exercise 2B

A- 2

B- 3

C- 0

D- 1

### Exercise 3

(possible answers) Albert Einstein, Galileo Galilei, Thomas Edinson, Charles Darwin, etc

### Exercise 5

A-0

B-1

C-2

D-3

### Exercise 6 A

Because it is important for development  
engineer, biologist, physicist, statistician, and software developer

### Exercise 6 B:

					
Name	She is Debora Tejada	She is Paola Tello	She is Yennifer Yuliana Ríos	She is Diana Trujillo	She is Blanca Huertas
City	She is from Medellin	She is from Bucaramanga	She is from Pamplona	She is from Cali	She is from Bogotá
Profession	She is a mathematician	She is a physicist	She is a professor at Mechanical Engineer School at Universidad Industrial de Santander	She is a aerospace	She is leading Colombian butterfly scientist and biologist
Qualities	She is disciplined	She is energetic	She is organized	She is positive	She is organized

### Exercise 8:

A- 0,4,2

B- 1,3,5

### Unit 3

#### Exercise 2:

A-2

B-1

C-2

D-3

#### Exercise 4 A

Highlighted words: fashion dolls, cars, rockets, toy telescopes, teddy bears, baby dolls, strollers, blocks, tool sets

#### Exercise 4B

1. teddy bears

2. baby dolls

3. strollers

4. cars

5. rockets

6. toy telescopes

7. blocks

8. tool sets

#### Exercise 4C

0. More adventurous

1. more - energetic

2. more - caregiving - than

3. prettier

4. are - more - strategic

5. smaller - than

#### Exercise 5B-

0. Boys' toys are more adventurous and more energetic than girls' toys

A. Boys' toys are more adventurous and more energetic than girls' toys

B. Some girls' toys like teddy bears, baby dolls, and strollers are more caregiving than boys' toys

C. For example, toys considered as "girls' toys", are prettier and smaller than "boys' toys"

D. Boys' toys like blocks or tool sets are more strategic than girls' toys.

E. For example, toys considered as "girls' toys", are prettier and smaller than "boys' toys"

#### Exercise 6

A. smaller-than

B. Fashion - prettier-than-blocks

C. baby- more- caregiving - than- cars

D. cars- more - adventurous- than - baby doll

# Answer key module B

## Unit 1

### Exercise 1

	<b>Maze 1</b> Geologist		<b>Maze 2</b> Biologist
			
<b>Mines</b> 		<b>Jungle</b> 	

### Exercise 2

- 0 - 3
- A - 1
- B - 3
- C - 2
- D - 3

### Exercise 3

- 0. Brightest
- 1. hottest
- 2. biggest
- 3. smallest
- 4. coldest

### Exercise 5a

- 0. galaxy
- A. Planet
- B. nebula
- C. star
- D. bird
- E. reptile
- F. invertebrate
- G. Mammals
- H. fish

### Exercise 5b: no rtas

#### Exercise 5c

- 0. UIS
- A. Planetarium
- B. insects
- C. fish
- D. Natural History Museum

#### Exercise 6

- 0. the biggest
- 1. the brightest
- 2. the most interesting
- 3. the most incredible
- 4. the strangest
- 5. the oldest

#### Exercise 7b

- 0. You'll witness ... and the most interesting planets
- A. Get ready for an adventure at the most incredible museum in Bucaramanga!
- B. Step into the biggest cosmic adventure at the Planetarium UIS
- C. You'll witness the brightest stars
- D. Witness the strangest ... creatures
- E. Witness the strangest and the oldest creatures

#### Exercise 8

- A. The Sun is the brightest star in the Solar System
- B. Venus is the hottest planet in the Solar System
- C. Neptune is the coldest planet in the Solar System.
- D. Mercury is the smallest planet in the Solar System
- E. Jupiter is the oldest planet in the Solar System

## Unit 2

### Exercise 1

- 0. 4 Mariana doubts they can achieve their dream because they don't have a lot of money to study
- 2 Mariana says that the planetarium was amazing and that she wants to be an astronaut
- 3 Francisco says the planetarium was wonderful and that he wants to be an astronaut
- 1 Mariana and Francisco came from the planetarium
- 5 Francisco look at an advertisement

### Exercise 2a

1. Support
2. Scholarship
3. Apply
4. chance
5. NASA
6. Study

### Exercise 2b

0 - F: "We are looking for a ... colombian teenager girl"

1 - F: "We are looking for a positive ... Colombian teenage girl"

2 - F: "We are looking for a ... Colombian teenage girl"

3 - F: "To study and learn at NASA"

4 - T

### Exercise 3a

0. D
1. F
2. A
3. E
4. B
5. C

### Exercise 3b

0. will meet
- A. will play
- B. won't stay
- C. won't just listen

