TRENDS AND MEGATRENDS
IN EDUCATION

Gender Gaps in Artificial Intelligence:
New Expressions of Inequality.

The trends and megatrends in education report was created to inform and communicate relevant aspects at an international level regarding education and its impacts in Medellín.

Gender Gaps in Artificial Intelligence:
New Expressions of Inequality.

Technological advancements have revolutionized our lives in many ways, from the way we communicate to our work processes. These advancements are, in part, attributed to the development of various algorithms in the field of **Artificial Intelligence (AI)**, such as machine learning models, conversational AI, computer vision, and generative models. These systems and applications have grown rapidly, and their usage is high today, as they enable the resolution of highly complex problems, facilitating automation and process personalization with an efficient use of resources (Smart Citizenship, 2023).

Various AI-related **algorithms** have specific tasks. For instance, **machine learning models** can learn from data through a process called 'training.' In this process, the model is fed with a dataset and learns to identify patterns in the data. Once the model is trained, it can be used to make predictions on new data. Machine learning models are employed in a wide range of applications, including medical diagnosis, fraud prediction, product recommendation, and student dropout prediction in post-secondary education.

Another field of AI is that of **conversational models or chatbots.** These models can simulate a conversation with a human. This is achieved through language models that can generate text, translate languages, and provide informative responses to questions. Conversational models are used in various applications, such as customer service, virtual assistants, and chatbots. We regularly interact with various models, including examples such as ChatGPT, developed by the company OpenAI. This virtual assistant is designed to help users with specific queries; Alexa, developed by Amazon, capable of performing a wide range of functions, such as playing music, setting alarms, and controlling smart home devices, among other possibilities. Nowadays, many websites feature chatbots that can assist users with questions and issues.

Computer vision is another field of AI, which deals with computers' perception of the real world through images and videos. These models are used for object recognition, facial recognition, and autonomous driving.

Finally, **generative models** are currently in the spotlight and are regarded as a 'powerful tool' as they can generate new data that is similar to what they were trained on. These models are used in a wide range of applications, such as generating images, videos, and music.

AI models are mathematical models that operate on numerical data. To work with text, images, or video, **the technique of embedding** must be used, which represents non-numeric data in a numerical form (vectors) that can be understood by AI models.

On the other hand, AI models not only follow user requests but also learn, although they can learn very poorly. This is because AI models are trained with data, and **data can be biased**. In some cases, the person responsible for developing or customizing these algorithms may inadvertently reflect biases in the model. Some of these biases can be socioeconomic, racial, or gender-related.

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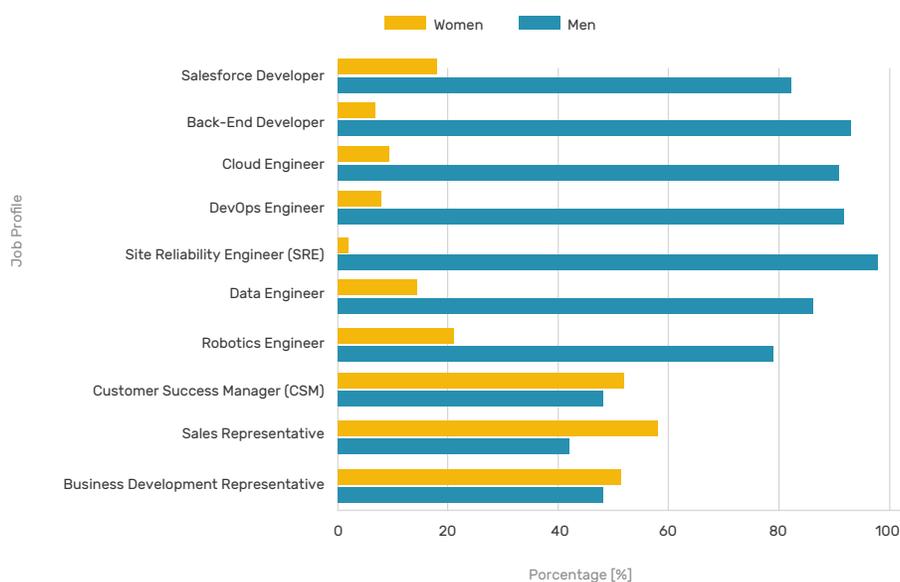Distrito de
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For example, an AI model trained on a dataset of medical patients may learn to be more prone to diagnosing men with cancer than women, even if the data doesn't show any real difference in cancer incidence between men and women.

To mitigate biases in AI models, **it is essential to be aware of potential biases** and take measures to address them. This includes emphasizing the importance of using a variety of data in the model training process, employing unbiased evaluation methods, being transparent about the data and algorithms used in the models, **and actively including women in all stages of the design**, development, and implementation of AI systems.

According to UNESCO's information in (Rubel, 2021), by the year 2022, **85% of AI projects produced incorrect results due to biases.** This issue is of significant importance and demands a prompt solution. Rubel argues that by increasing women's participation in AI development and fostering awareness regarding biases, we will contribute to the creation of **more equitable and unbiased systems**, benefiting society as a whole.

In light of the above, it is timely to conduct a thorough review of female participation, both in educational programs and in the industry. This initiative is aimed at promoting greater presence in the STEAM (Science, Technology, Engineering, Arts, and Mathematics) field, with the goal of encouraging equitable and enriching participation in critical areas for innovation and technological development. In this regard, it is important to examine the current gender participation landscape in various prominent job profiles in Colombia during the year 2023 (see Graph 1).
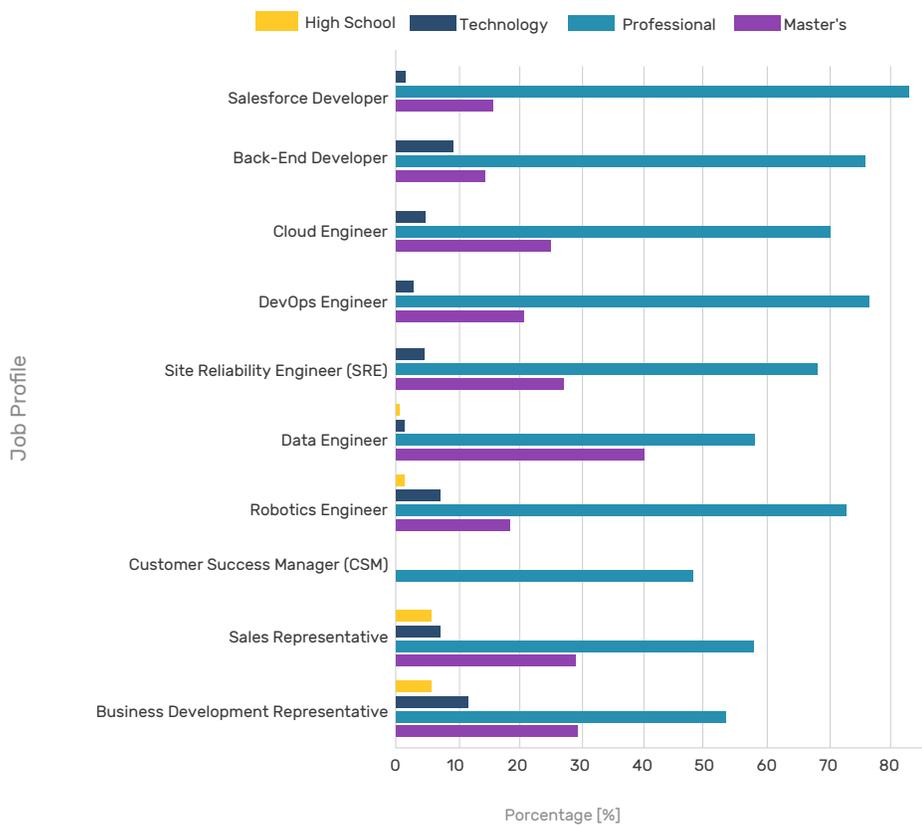
Graph 1. Gender Participation in Various Job Profiles in Colombia in 2023.

Source: LinkedIn News Latin America - Booming Jobs in Colombia 2023.

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Given the limited female representation in academia in STEAM areas, which is only at 11%, as well as in high-responsibility positions in the corporate IT sector, with a mere 5%, the need for action becomes even more evident. **This gender inequality is also reflected in the field of AI**, where only 22% of professionals are women. It is clear that as the technology industry advances, it is imperative to ensure the active inclusion of women in all development processes and secure their meaningful presence at all hierarchical levels (Entel OCEAN, 2019). In this regard, the following image provides a specific perspective on the percentage of participation in various educational levels in the job classification for the year 2023.

Graph 2. Percentage of Participation of Different Education Levels in Job Classification for 2023.
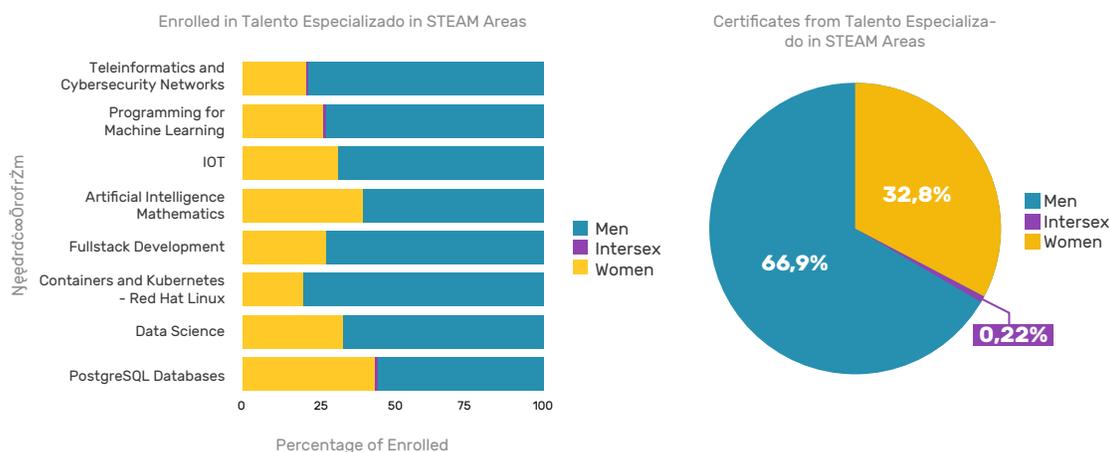

Source: LinkedIn News Latin America - Booming Jobs in Colombia 2023.

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Due to the low participation of women in the STEAM field and the presence of gender biases both in academia and the industry, numerous models have been created that reflect this bias when interacting with humans. An example is the case of Amazon, which in 2022 discovered that its AI system called Mechanical Turk, used to hire independent workers, **displayed gender bias by underestimating the skills of women compared to men.** This was because the system was trained on biased data that contained more information about men than women. Despite efforts, Amazon couldn't correct this bias in the model, leading to the removal of the developed tool.

Gender bias in algorithms can harm women by recommending products and services more favorably to men, making it harder for them to access important resources. Additionally, these algorithms can favor men in hiring and promotion processes, complicating job searches and professional advancement for women. They may also assess men more positively, preventing women from getting salary increases and promotions.

Taking into account the aforementioned, one of the projects offered by **Sapiencia** is the **TALENTO ESPECIALIZADO** program. This project aims to provide training and education to young and adult individuals in fields related to the industry 4.0 through short and modular courses. In the last two years, a total of 19,675 individuals have enrolled in the various programs offered, of which 59.14% are male, 40.68% are female, and 0.16% identify as intersex. Additionally, the representative group participating in programs related to STEAM areas can be observed in Graph 3.

Graph 3. Percentage of Participation of Youth and Adults in STEAM Programs.

Source: Sapiencia's Own Data. Data from the Talento Especializado Program.

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The existence of this set of IT programs reveals a male predominance both in the registration phase and in the completion of courses with the attainment of certificates. To address the current situation of female participation in this field and **reduce gender disparity**, it is crucial to promote greater representation of women in various areas. This approach aims to fine-tune the performance of systems and tools when interacting with them.

Achieving this purpose involves the active inclusion of more women in development and programming roles. For this, it is essential to create more opportunities that encourage the incorporation of women in the STEAM field. This can be accomplished by establishing spaces that inspire their interest, such as technology-related communities **(DATA SCIENCE FEM, PyLadies Colombia, django girls, among others)**. These communities provide the opportunity to learn about technological aspects, build professional networks, and access specialized courses.

Simultaneously, continuing education programs focused on Industry 4.0 should be offered. The participation of women in disciplines such as engineering and mathematics can also be encouraged, fostering a broader diversity in these fields. Taken together, these initiatives initiatives will help to **balance gender representation in the technology field** and boost the quality and relevance of the boost the quality and relevance of the resulting technology solutions.

To reduce the gender gap in AI developments, various measures can be effective. One option is to promote diversity in the team responsible for creating these algorithms. Additionally, it is essential to employ algorithmic design approaches that are gender bias-aware. Finally, the importance of conducting comprehensive model evaluations to detect and address any bias is emphasized. **These actions contribute to creating a more equitable and fair environment for women.**

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