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The Gender Gap and Ethical Challenges in the Development of Emerging Technologies in the Field of Systems Engineering

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Abstract— Emerging technologies, such as Artificial Intelligence (AI), Big Data, and automated systems, have revolutionized the digital structure of contemporary society, optimizing organizational processes and redefining human-machine interaction. However, their development has brought with it a series of ethical dilemmas related to privacy, the processing of personal data, and equity in the digital environment. Given this reality, computer ethics emerges as a key tool for establishing responsible frameworks for action and ensuring the well-being of users. This article also addresses the gender gap in the technology field, evidenced both by the low female participation in STEM careers and by the persistent stigmas surrounding the capabilities of men and women. Based on surveys conducted among high school and university students, this article analyzes perceptions regarding these challenges, highlighting the need to promote more inclusive, ethical, and diverse educational and professional spaces.

Index Terms— Emerging technologies, computer ethics, artificial intelligence, gender gap, algorithmic transparency, STEM careers, digital privacy, equity, Big Data, automated systems.

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INTRODUCTION

Emerging technologies have significantly transformed the development of digital tools in 21st-century society, with Artificial Intelligence (AI), Big Data, and automated systems standing out as key elements in optimizing work and organizational performance. Although the origins of AI date back decades, its recent evolution has enabled its effective integration into various social and professional areas, establishing itself as an assistant for decision-making and operational support in multiple environments. Big Data, for its part, has emerged in response to the challenge of processing, analyzing, and classifying large volumes of information generated by digital platforms, databases, and even AI systems themselves. This technology focuses on studying five fundamental dimensions: volume, velocity, variety, veracity, and value of data, with the aim of determining their utility within complex information systems [Hernandez-Leal, Duque-Mendez & Moreno-Cadavid, 2017].

Likewise, automated systems have driven a substantial improvement in process efficiency across labor, social, and economic sectors. From automated production of goods to the implementation of chatbots for customer service, these technologies have demonstrated their usefulness in transforming the interaction between organizations and users [Alastruey, 2021]. However, the accelerated advancement of these technologies has also brought a series of ethical dilemmas that increasingly concern a society immersed in the digital environment. Among these challenges are the massive processing of personal data without clear consent, the ambiguity of privacy policies, and the risks of discrimination by algorithms that can reproduce or even amplify biases related to gender, race, or social class.

DEVELOPMENT OF EMERGING TECHNOLOGIES

Artificial Intelligence (AI) has acquired a leading role in recent years, both in the structural and functional transformation of automated systems and in its impact on human development. Its influence is perceived not only through the innovation it sparks in individuals and organizations but also through its ability to simulate processes characteristic of human thought and behavior, thereby influencing the way we interact, learn, and make decisions. From an academic perspective, AI can be defined as a branch of knowledge aimed at developing computational systems capable of performing tasks based on two essential human characteristics: reasoning and behavior [Alastruey, 2021]. In this regard, AI seeks to emulate skills such as perception, learning, communication, and problem-solving, paving the way toward more intelligent forms of human-machine interaction.

Although technologies such as Big Data and automation have also generated profound impacts on society and are closely linked to AI development, the latter stands out for its ability to represent and simulate traditionally human attributes, such as dialogue, contextual intelligence, and adaptation to different environments. As stated, AI has not yet reached full maturity, but it is projected as a key tool in configuring personalized environments, both in education and other fields, through the use of expert systems and adaptive interfaces [Lengua Cantero, Bernal Oviedo, Florez Barboza & Velandia Feria (2020)]. Thus, AI not only transforms technical processes but also redefines the relationship between people and technology, constantly challenging traditional ethical, social, and pedagogical frameworks.

As a consequence of accelerated growth and the progressive incorporation of emerging technologies in all areas of daily life, multiple ethical dilemmas have arisen that generate concern not only among computer science experts but also across broad sectors of society. Families, organizations, national and international authorities, as well as judicial bodies, have begun to demand greater guarantees on sensitive topics such as digital privacy, the use and processing of personal data, algorithmic transparency, and potential discrimination generated in automated digital environments. This growing concern demonstrates that the impact of technology can no longer be evaluated solely from the standpoint of its functionality or efficiency, but also from the ethical principles that guide its design, implementation, and use in daily life.

Montuschi, in an article developed in collaboration with CEMA University in Buenos Aires, presents two fundamental perspectives on the use of emerging technologies. On one hand, there is the vision centered on efficiency and technical progress, which promotes the implementation of these tools as mechanisms to optimize processes, reduce errors, and increase productivity across various domains. On the other hand, there is a more critical perspective that invites reflection on the social, ethical, and human impacts that the massive adoption of these technologies entails, especially regarding individual autonomy, privacy, and social justice.

These have had effects that can be considered highly convenient and positive for people's lives and for the activities of organizations. But it is also true that new possibilities also open up for the use of these new technological means in operations that cannot be seen as good or positive for either individuals or institutions [Montuschi, L. 2005].

To address these challenges, a contemporary approach known as computer ethics is employed, which aims to establish a normative and reflective framework to guide individuals' behavior in digital environments. This discipline focuses on structuring ethical and moral principles, along with norms, standards, and regulations that ensure user well-being, protect their rights, and foster respectful and supportive relationships among peers. Its relevance has grown due to the accelerated technological advancement and the profound changes in social dynamics, where the boundaries between public and private have become blurred. In this context, computer ethics acts as an indispensable tool for understanding and regulating the new forms of digital interaction that emerge in an increasingly technology-mediated society. Silva and Espina point out that,

These technologies definitively propose new lifestyles and ways of thinking; they raise new paradigms of relationships among individuals, hence the emergence of ethical problems in their use and the need to

conduct studies that provide solutions to achieve social well-being and the preservation of a computer culture in organizations [Silva, N. & Espina, J. 2006].

COMPUTER ETHICS

To discuss computer ethics, it is necessary to break down the concept and understand its components separately. First, ethics has been a discipline subject to multiple interpretations throughout the history of thought. In this article, we adopt the definition proposed by Gonzales and Martinez, who argue that "ethics is a philosophical discipline, having a normative and practical character, about how to act in the social environment in which the individual is embedded [...]" [Gonzales, M. & Martinez, D., 2020]. Under this perspective, ethics acts as a theoretical framework that guides individual social conduct, forging the pillars of morality from principles and values that allow discerning, in practice, what is most beneficial both for the community and for the individual, according to their actions.

On the other hand, the concept of computer science must also be precisely delineated. According to Silva, "computer science should now be understood as the science of rational information processing through the use of computers; considered as the support of knowledge and human communications" [Silva, 2006]. This definition allows interpreting computer science as the field of knowledge that converts all types of information into logical and processable sequences through the use of computational devices. In these devices, information is stored, transformed into data, and used as a basis for communication processes and knowledge management in digital environments.

In this way, computer ethics is configured as an essential element for establishing the boundaries of conduct in the digital environment. Its main function is to ensure the well-being of users on the network, ensuring adequate and responsible treatment of their personal information, and addressing other issues arising from the intensive use of emerging technologies. This discipline seeks to promote respectful, equitable digital interaction oriented toward the common good, in which virtual relationships are guided by principles of responsibility, transparency, and mutual respect. In this context, the presence of ethical professionals becomes especially relevant, as they are the ones who must lead the way toward sustainable technological development committed to social progress. As Gonzales and Martinez affirm, "Today's society requires individuals responsible for their actions, projects, and achievements; it needs a purpose - only from such a context does ethics make sense, and therefore it establishes rational foundations and norms of moral behavior" [Gonzales, M. & Martinez, D., 2020].

Within the field of computer ethics, various dilemmas and issues emerge in relation to the digital environment and the rapid technological advancement experienced by contemporary society. To deepen understanding of these aspects from an educational perspective, a sample of 37 eleventh-grade students from a private school in the municipality of Dosquebradas, Risaralda, was selected. This population was chosen to identify the main ethical risks to which young people may be exposed when interacting with websites, social media, or other digital environments. The purpose of this research is to understand how students perceive and confront issues such as personal data management, privacy, cyberbullying, identity theft, and other situations that directly affect users' digital experience.

ETHICAL DILEMMAS

Among the results obtained from the applied survey, various perceptions regarding the ethical dilemmas and issues that may arise in the digital environment were identified. The surveyed population consisted of students between 15 and 17 years of age, who responded to a set of questions designed to explore both their vocational orientation and their level of awareness regarding digital risks and gender equity in the technological field. The questions included: What is your preferred career choice? (both first and second choice), What do you believe is a person's main fear when accessing websites or using social media?, What do you consider your biggest mistake when browsing the internet or using social media?, What is your opinion on the gender gap between women and men in the workplace?, and Why do you think this situation occurs? The responses obtained provide an initial overview of how young people understand the ethical

challenges associated with technology use, as well as their perceptions regarding gender inequality in professional contexts related to computer science and digital development.

Table 1.Ethical dilemmas perceived by individuals in the digital environment and their possible causes.

DILEMMAS/PROBLEMS	**Frequency**	**POSSIBLE CAUSES**	**Frequency**
PRIVACY/SECURITY (HACKING)	16	COOKIES AND PRIVACY TERMS	10
PERSONAL DATA	12	VERIFY WEBSITE SECURITY	12
FAKE NEWS	6	TRUSTING PERSONAL DATA	17
EXTORTION/FRAUD	7	APP PERMISSIONS	6
SOCIAL PRESSURE (OPINION)	1	INFORMATION ACCURACY	6
HARASSMENT	1	TIME SPENT	8
SENSITIVE CONTENT	1	LACK OF KNOWLEDGE	7

The table presents the main ethical dilemmas perceived by surveyed students regarding the use of digital tools, as well as the most frequent causes they themselves identify as the origin of these problems. The data reflect a high concern for privacy, digital security, and personal data processing, highlighting the need to strengthen education in responsible technology use and critical understanding of its risks.

The study findings show that one of the main dilemmas identified by respondents in the digital environment is linked to the management of privacy and information security, dimensions that remain at constant risk from cyberattacks and inadequate practices in personal data processing. This vulnerability is accentuated in contexts where the volume of information is ever-increasing and digital technologies evolve rapidly. According to Ona, Parrales, Vera, and Zhigue (2024), this fragility responds to the versatility and dynamism of the digital environment, where the use of Big Data and artificial intelligence allows manipulation of user-provided information to generate inferences about their profiles, largely due to the design of the algorithms that structure these systems [Ona, O., Parrales, L., Vera, M. & Zhigue, F., 2024].

It is worth noting that, in response to these types of issues, various national and international legislation and policies aimed at protecting personal data in the digital environment already exist. These regulations seek to guarantee the fundamental right to privacy, and their development began with the enactment of the first data protection law in Sweden in 1973. However, the lack of harmonization in the standards required for the design and operation of automated systems across different countries makes the effective application of these regulatory frameworks difficult, especially for organizations with international reach.

For this reason, companies are encouraged to adopt a proactive ethical stance that goes beyond mere legal compliance, ensuring responsible practices that do not generate negative social impacts.

In this regard, as Ona, Parrales, Vera, and Zhigue affirm, "Organizations must go beyond legal compliance and consider the social implications of their data management practices" [Ona, O., Parrales, L., Vera, M. & Zhigue, F., 2024]. In line with this position, Gonzales and Martinez (2020) call for collective action to strengthen the security of personal information and promote policies grounded in computer ethics, stating that "Individuals, society, and institutions must fight against the sinking of morality, the crisis of values, to achieve greater benefits [and] a better world, capable of confronting ethical dilemmas" [Gonzales, M. & Martinez, D., 2020].

Although these issues represent the most common risks and generate a high level of concern among users, there are other equally relevant factors that are frequently underestimated when evaluating the impact of digital technologies. Among these are issues such as the social and ethical implications of artificial intelligence, the need to develop transparent algorithms that ensure equity in automated decision-making, and the social responsibility that professionals must assume when designing and implementing technological systems. These aspects, although less visible in the everyday user experience, are fundamental to building a fair, secure digital environment oriented toward collective well-being.

Regarding the implications of artificial intelligence, it is possible to identify various issues that affect the social, political, economic, and cultural spheres. The misuse of this technology has enabled malicious actors to develop practices such as identity theft, the generation of false scenarios, and the alteration of truthful information, leading to the dissemination of erroneous messages that violate people's dignity, intrude on their privacy, and expose their personal data without consent. These actions, in addition to directly affecting individuals, also jeopardize the integrity of broader social systems. A clear example of this manifests in the political context, where the illegitimate use of AI has been reported to manipulate electoral campaigns, influence public opinion, and misinform the electorate. As Gonzales and Martinez point out, "the illegitimate application of AI is questioning ethical precepts in the field of ideology and politics, disrupting the legitimacy of democratic processes" [Gonzales, M. & Martinez, D., 2020].

This situation has generated a growing level of concern and distrust among citizens toward the mechanisms and democratic systems that govern political campaigns in different nations. A recent case that illustrates this issue occurred during India's national elections in , where artificial intelligence was used through chatbots programmed to influence citizens' voting intentions. According to Benerjee, Dutta, and Dutta (), these tools allowed manipulation of voter perception through the creation of highly personalized experiences, which included simulated dialogues with digital avatars of political candidates. This strategy, supported by AI, sought to reinforce the voter's emotional affinity with their preferred option, thereby altering the democratic process through automated and targeted persuasion techniques [Benerjee, D., Dutta, S. & Dutta, S.,].

In response to this issue, the concept of "algorithmic transparency" was introduced, which is defined as "the availability of information about algorithmic systems that allows understanding their operation and assessing their performance" [Constitutional Court of Colombia, 2024]. This concept seeks to ensure, as its name indicates, transparency in the operation and structure of the systems that comprise the source code of any website or mobile application developed with public funds. Furthermore, the private sector is urged to comply with high standards of explainability and ethics in the development of technologies such as artificial intelligence, with the aim of safeguarding the privacy and security of user data. As explained by Claro, Castellanos, and Villegas (2024), "in accordance with the foregoing, algorithmic transparency poses a balance in technological innovation, promoting legal guarantees for fundamental rights, fostering ethical, responsible, and people-centered artificial intelligence" [Claro, Y., Castellanos, M. & Villegas, A. 2024].

This term becomes especially relevant in Ruling T-065 of 2024 of the Constitutional Court of Colombia, which analyzes the case of a user affiliated with a health insurance provider (EPS) who was denied access to the source code of the CoronApp application, developed with public funds. The justification for this denial was the alleged risk of exposing sensitive user data by allowing access to the application's internal structure. However, upon reviewing the case, the Court ruled in favor of the petitioner, considering that their fundamental right to access public information was being violated. In its decision, the high court urged the application developers to establish mechanisms that would allow source code review without compromising the security and privacy of users' personal data. In the Court's own words,

Transparency in the use of this tool is a fundamental guarantee to ensure adequate and reasonable use of personal data and to prevent the use of algorithmic systems for decision-making by public entities from resulting in arbitrary or discriminatory decisions [Constitutional Court of Colombia, 2024].

This precedent demonstrates how algorithmic transparency can contribute to improving the management of digital information, promoting a more ethical, secure, and trustworthy digitization for all citizens.

Although many of these dilemmas have been the subject of proposals, solutions, and mitigation attempts from different spheres, the review and oversight of certain source codes, as well as the analysis of specific situations, reveal a deeper structural problem: the gender gap in the computer science field. This inequality, often invisible in technical debates, not only limits the equitable participation of women and other identities in technology development but also directly influences the way digital systems are conceived, programmed, and evaluated. Thus, the lack of diversity in work teams can reproduce biases, ignore relevant perspectives, and perpetuate exclusionary structures within the technological environment.

GENDER GAP

The historical difference between men and women has represented one of the most persistent social problems across different civilizations, and although significant progress has been made in addressing it, manifestations of inequality still persist in contemporary society. This gap, in both its direct and indirect expressions, continues to be evident in multiple fundamental areas of human development, such as the social, political, and economic spheres. Despite efforts to achieve equity, women continue to face structural and cultural barriers that limit their full participation in various spaces, reflecting a problem that requires constant attention from ethical, educational, and legislative approaches.

To study perceptions of this social problem, two studies were conducted in different populations. The first test was applied to students at a private school in the municipality of Dosquebradas, Risaralda, with the aim of identifying their professional aspirations in relation to STEM careers (Science, Technology, Engineering and Mathematics), especially those linked to the computer science area, such as systems engineering, mechatronics, electrical, software, and biomedical engineering. Additionally, their perception of the gender gap in the workplace and the possible causes that generate it was explored. The second test was conducted with first-semester Systems Engineering students at the Technological University of Pereira (UTP), and its purpose was to estimate the gender proportion within the academic program. Their perception regarding the gender gap in both academic and professional contexts was also investigated, as well as their motivation to continue with the program. For the first test, a total of 37 people were surveyed, and for the second test, a total of 55 people.

The results obtained from the tests were as follows:

TEST #1

Table 2. Career aspiration among young high school students.

STEM (Science, Technology, Engineering and Mathematics)		
Age	**Frequency**	**Sex**

15 years	2	**Male**	**Female**
16 Years	28		
17 Years	2	19	13
Total	32		
STEM-related careers focused on Systems, Mechatronics, Electrical, Software, Biomedical, etc.			
Age	**Frequency**	**Sex**	
15 years	1	**Male**	**Female**
16 Years	9		
17 Years	1	9	2
Total	11		
Otras carreras			
Age	**Frequency**	**Sex**	
15 years	0	**Male**	**Female**
16 Years	4		
17 Years	0	2	2
Total	4		
Does not know / No response			
Age	**Frequency**	**Sex**	
15 years	0	**Male**	**Female**
16 Years	1		
17 Years	0	1	0
Total	1		

The table shows the distribution by age and sex of surveyed students regarding their interest in STEM careers, differentiating between those specifically oriented toward the technology area (such as Systems Engineering, Mechatronics, Electrical, Software, and Biomedical Engineering), other professional careers, and those who did not respond. Greater male participation in technology programs is evident, reflecting a possible influence of gender stereotypes on vocational choice, a central aspect of this study's analysis.

Regarding the interest in pursuing a STEM career among eleventh-grade students at the private school, results show that approximately 86.4 percent of the surveyed population expressed aspirations toward a career in Science, Technology, Engineering, or Mathematics, of which 59.3 percent were male and the rest female. At first glance, this distribution might suggest relatively balanced participation between both genders. However, the difference becomes more evident when specifically analyzing interest in careers related to the computer science field, such as Systems Engineering, Mechatronics, Electrical Engineering, Software Engineering, or Biomedical Engineering. Of the 32 people interested in STEM careers, only 11 expressed interest in studying programs in the computer science area, and of those 11, only 2 were women. This data reveals a significant disparity in the choice of technology careers, reinforcing the need to continue addressing the gender gap from early stages of the educational process.

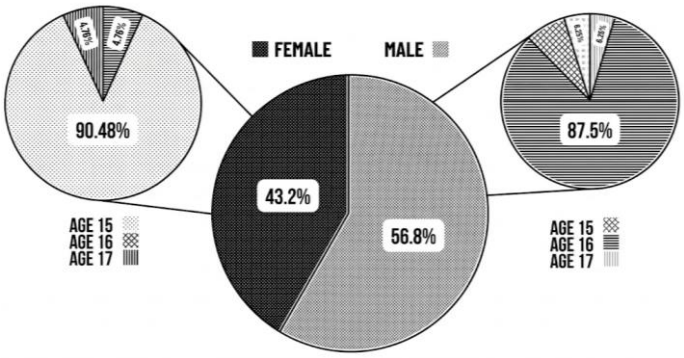

Fig. 1. The graph represents the distribution by sex and age of the students surveyed in the study. The central chart shows the overall proportion between male (56.8 percent) and female (43.2 percent) participants. The side charts indicate that most respondents are 16 years old (90.48 percent of women and 87.5 percent of men), which allows contextualizing the results from a generational perspective. This information is key to interpreting youth perception of digital ethics and the gender gap in technology fields.

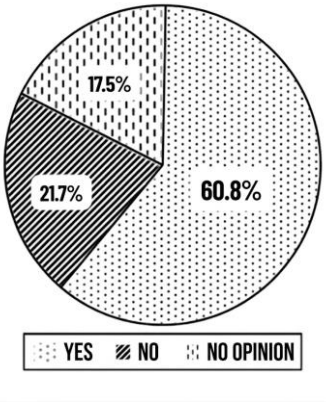

Fig. 2. The graph reflects the perception of surveyed students regarding the existence of a gender gap in the workplace and academic environment. 60.8 percent consider that this gap does exist, while 21.7 percent claim not to perceive it. Notable is the 17.5 percent who chose not to express an opinion, which can be interpreted as a lack of critical positioning regarding a relevant social issue.

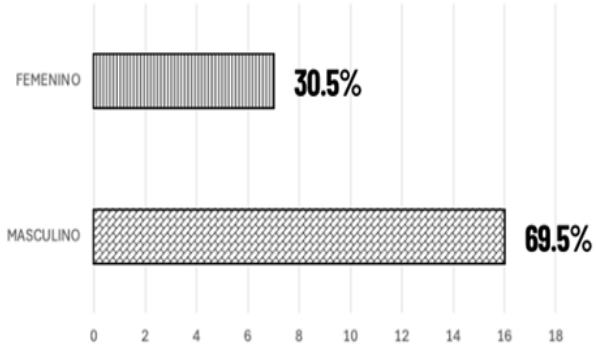

Fig. 3. The graph presents the distribution by sex of students who affirmed perceiving a gender gap. 69.5 percent of those who recognize this inequality are men, while 30.5 percent are women. This result suggests that the perception of the gap is not exclusive to the affected gender but is also being recognized by the male majority, which represents progress in terms of collective awareness and co-responsibility regarding gender inequalities in educational and professional settings.

Regarding the perception of the gender gap, results show that 60.8 percent of respondents recognize the existence of inequality between men and women in the workplace, while 21.7 percent claim not to perceive such a gap. However, a particularly concerning finding is the 17.5 percent of students who chose not to express an opinion on the matter. Although this figure is lower compared to those who adopt a defined stance on the dilemma, it raises a relevant concern: the lack of positioning by a portion of the youth population regarding a problem that directly affects many women, possibly including members of their own close circle. This indifference or lack of critical awareness may reflect educational gaps in gender equity topics and underscores the need to strengthen ethical and social education in school settings. In a study conducted by Hernandez and Hernandez () on the perception of this gender gap, especially in obtaining a job position, results showed a preference for male profiles in certain jobs and, at times, women were solicited for lower-level tasks. In the same document they state that,

They pointed out that one of their main challenges was related to gender status, as they argue that in some published vacancies men are requested as the desired profile, and on various occasions organizations hold the belief that women aspire to low-level positions, that is, more operational jobs [Hernandez, C. & Hernandez M.].

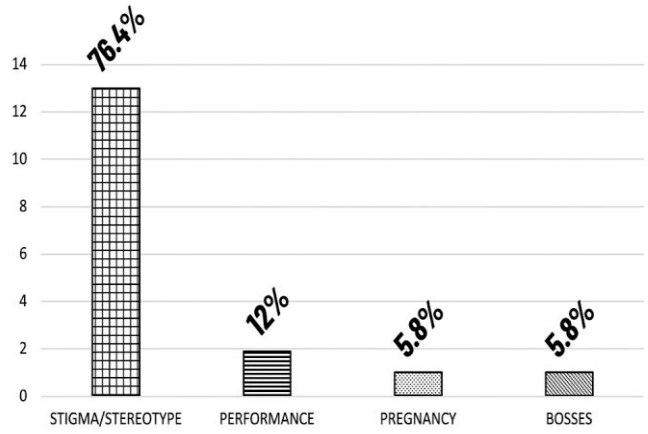

Fig. 4. The graph shows the main causes that, according to the surveyed students, contribute to the existence of the gender gap. 76.4 percent identify gender stigma or stereotypes as the most determining factor, followed by academic performance (12 percent) and, to a lesser extent, pregnancy and decisions by bosses or superiors (both at 5.8 percent). These results demonstrate that social perception regarding gender roles remains the most significant barrier to equity in academic and professional technology contexts.

Among those who responded affirmatively regarding the perception of a gender gap, it was identified that the majority (76.4 percent) consider that the stigmas and stereotypes associated with gender roles directly influence both the choice of STEM professional careers and access to employment opportunities. Likewise, 12 percent of respondents attribute this gap to individual performance, while 5.8 percent mention factors such as pregnancy or decisions made by bosses or superiors. This collective perception finds support in the approach of Hernandez and Hernandez (2024), who cite Weeden, Gelbgiser, and Morgan (2020) to explain how stereotypes influence self-assessment of abilities by men and women, especially in scientific and mathematical areas. Through the so-called "expectancy theory", these authors argue that both men and women develop beliefs about their level of competence in certain fields, and although women may obtain grades equal to or even higher than men's, they tend to underestimate their abilities. In contrast, men persist in their participation in these areas, even when their results are not necessarily better [Weeden, K. A., Gelbgiser, D., & Morgan, S. L., 2020, cited by Hernandez, C. & Hernandez, M., 2024].

TEST #2

Table 3.Classification by age and sex of surveyed individuals.

/ Sexo Edad	Male	Female
16 Years	10	2
17 Years	25	4
18 Years	8	2
19 Years	2	0
20 Years	1	0
22 Years	1	0
Total	47	8

The table presents the distribution by age and sex of university students surveyed in the study. Of the 55 participants, 47 are men and only 8 are women, reflecting a marked gender disproportion in enrollment in the Systems Engineering program. Most respondents are between 17 and 18 years old, which allows interpreting the results from an early generational perspective, at a key stage for the consolidation of academic trajectories in STEM careers.

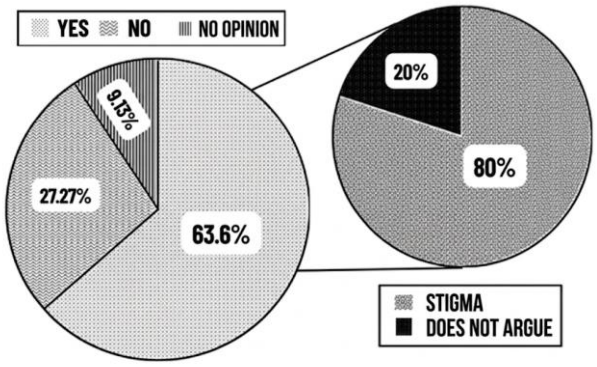

Fig. 5. The graph shows the perception of university students regarding the existence of a gender gap, as well as the causes they associate with this issue. 63.6 percent of respondents affirm recognizing the presence of this gap, while 27.27 percent do not perceive it and 9.1 percent choose not to express an opinion. Among those who recognize the gap, 80 percent identify gender stigma or stereotypes as the main cause, while 20 percent do not elaborate on their response.

The second test, applied to first-semester students in the Systems Engineering program at the Technological University of Pereira (UTP), concretely reflects the problem identified in the first survey. Of a total of 55 surveyed individuals, only 8 were women, representing merely 14.54 percent of the sample, while the rest were male students. This figure clearly reveals the marked absence of women in the computer engineering field and reinforces the persistence of a gender gap in this area. Furthermore, of the total participants, 63.6 percent recognized the existence of this gap, and 80 percent of them attributed this inequality to the social stigma or stereotype that conditions female participation in technology careers.

In relation to this perception, Costa, San Martin, Pinto, and Gatica (2022), in an article published by the scientific journal SciELO, point out that "the literature indicates that women orient their vocation toward community/social objective programs, particularly in the areas of health and education" [Costa, G., San Martin, L., Pinto, O. & Gatica, G., 2022]. This statement helps understand that the stigma is not limited solely to the idea that women should hold operational or lower-level positions, but also responds to a cultural construction that links their vocation to social, care, or assistance work, relegating their potential in scientific and technological areas to the background.

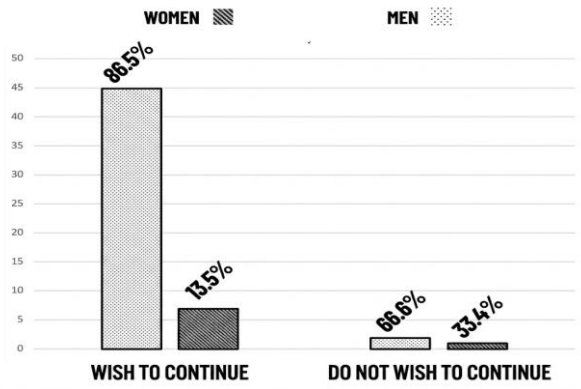

Fig. 6. The graph presents the intention to remain in the Systems Engineering program according to the sex of the surveyed students. 86.5 percent of students, mostly men, expressed their desire to continue in the program, while only 13.5 percent of those who wish to continue are women. On the other hand, of the few who do not wish to continue, 66.6 percent are women and 33.4 percent are men. Although female representation in the sample is low, these data reflect that women who enter the program tend to show a high level of commitment to their educational process, which represents a hopeful sign in the face of the persistent gender gap in the technology field.

Finally, university students were asked about their intention to continue in the program, and the results were encouraging. Of the 55 respondents, only 3 expressed not wanting to continue, of whom only 1 was female. This finding, although reflecting a low initial representation of women in the program, also offers a positive perspective, as it indicates that those who enter STEM programs - in this case, systems engineering - show willingness and commitment to remain in the educational process. Despite the concerning landscape regarding low initial interest or access of women to these areas, these results enable maintaining hope that, once enrolled, many of them are determined to continue and consolidate their academic trajectory in the technology field.

CONCLUSIONS

From the analysis of the results obtained and the general context addressed throughout the article, it is confirmed that the gender gap in STEM careers, and particularly in the technology area, remains a current problem in today's society. This situation is evidenced both by the low participation of women in the Systems Engineering program and by the limited female aspiration toward professional programs in the computer science field during the school stage. One of the most influential factors in this reality is gender stereotyping, a deeply rooted sociocultural construction that has historically conditioned perceptions about female capabilities, relegating women to roles considered "more suitable" or "natural" for their gender, while technological competencies are associated with masculinity.

Although initiatives have been promoted to foster inclusion and equity in access to higher education in scientific and technological fields, cultural change is slow and requires sustained interventions from education, public policy, and the productive sector. However, the results of this study also allow identifying encouraging signs, such as the high intention to remain on the part of women already enrolled in Systems Engineering, of whom only one expressed wanting to leave the program. This finding, although modest, demonstrates that women who enter these programs not only possess the necessary competencies but also show determination and commitment to their education.

In this regard, promoting more inclusive academic spaces, breaking with traditional stigmas, and making female role models in technology visible becomes fundamental to continue advancing toward equitable education and a society that values talent without gender distinction. Transformation is possible, but it requires collective effort and a professional ethics that accompanies technological development with justice and equality.

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