

**High school youth, science and gender. An approach in the confinement COVID-19****Juventud de educación media superior, ciencia y género. Un acercamiento en el confinamiento COVID-19**

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**Abstract**

**Resumen**

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## Introduction

Feminist theory has questioned the supposed neutrality of science, and explains the subtle discrimination of women, highlighting biases in the selection and promotion processes in science, and furthermore, has explained the difference in access and performance of female students compared to male students in science subjects and analysed its repercussions. She also explained why many female researchers do not receive recognition for their work.

Despite the above, women in the second decade of the 21st century still face stereotypes and live in an androcentric society where girls and young women are still being told how they should behave and what their destiny will be; the unfortunate fact is that this inequality of opportunities starts in the family, followed by the school, the church, and culminates in the media and recreational activities. Hence the following question arises:

What are the causes of the fact that there are few young women at the university stage who opt for careers in science and technology: lack of dissemination, family support, resistance, promotion of gender stereotypes in the media and/or within the classroom at the beginning of school age that promote shyness in the approach to science and technology?

In this sense, the present work describes the situation experienced by young university students in Higher Secondary Education in relation to their perception of science and technology in the context of the pandemic caused by COVID-19.

It should be noted that this research is the result of a project funded by the "University Productivity through Research" call entitled: Youth and science. Strategies to strengthen interest in science and technology in high school students at the Autonomous University of Nayarit through the elimination of gender stereotypes and scientific dissemination.

### *Gender and science*

In 1965 Alice Rossi dared to ask the question: Why so few? Martha I. González García (2018) and mentions:

The article that Alice Rossi published in the journal *Nature*, as well as the work of denunciation and vindication of a good number of women, mostly scientists, in the 1960s and 1970s had an important and lasting effect. The women who at that time spoke of emancipation and began to occupy the desks of universities as students and the laboratories and research groups as scientists found themselves in a mostly male world, a world designed by and for men. Science, precisely the paradigm of neutrality and objectivity, the best product of human reason, was also not immune to gender bias. (González, 2018 p: 6)

The history of women in science has been told through historians who in their patriarchal eyes were only allowed to recognise researchers, which shows the biases throughout scientific documentation in which women have been invisibilised.

González in her book: *Science, technology and gender* (2018), details research on forgotten women:

"It has been discovered, for example, that various philosophical schools, such as Platonic, Pythagorean and Cynic, admitted women, and that there were female scientists in antiquity, such as the astronomer Aglaonice (2nd or 1st century BC. BC), the physicians Agnodice (4th century BC) or Metrodora (1st or 2nd century BC), or the great philosopher, astronomer and mathematician Hypatia of Alexandria (Pérez Sedeño 1993, 1994). During the Middle Ages, convents provided an ideal place for some women to devote themselves to study and research, such as Hildegard of Bingen (11th-12th c.), whose work became known as the "nunnery". XI-XII), whose work dealt with "the nature of man, the moral world and the material universe, the spheres, the winds and humours, birth and death, the soul, the resurrection of the dead and the nature of God"; or Trotula of Salerno (XI c.), professor of medicine at the Medical School of Salerno (which admitted women as students and teachers) and a specialist in women's medicine.

The birth of European universities between the 12th and 15th centuries constituted a major barrier for women, as they were forbidden to enter. Nor was the birth of modern science kind to women. Academies founded during the scientific revolution, such as London's Royal Society (1660) or the Parisian Académie des Sciences (1666), also vetoed their entry. (González, 2018, p.10)

According to Rodríguez, Medina and Crespo (2020), Mexico is facing the Fourth Industrial Revolution, as is the rest of the world (Rojko, 2017). And in a special way we know that Latin American countries have not yet effectively integrated STEM Education therefore there is still a strong inclination of young people for social sciences (Montgomery & Fernández-Cárdenas, 2018), cited by Rodríguez, Medina & Crespo, (2020).

Different authors point to the urgent need to establish strategies for the promotion of scientific vocations from childhood, with some research pointing to the family as a fundamental role in the choice of STEM careers.

With the integration of technology in the classroom, educational institutions have added the digital label, however, there are not many practices through ICT to educate in gender equality (Prendes, García and Solano, 2020). They also mention the unequal access between men and women to STEM subjects, with a marked gender gap in both the professional and academic fields, in reference to technology and point to stereotypes related to lower female technological skills, the absence of female references and teacher training as causes. (Prendes, García and Solano, 2020).

García-Peñalvo (2020) in her study entitled: Empowering Women in STEM careers refers to the gender gap in STEM subjects as a reality that affects all countries to a greater or lesser extent. Although globally there are more women than men enrolled in higher education, these figures are not the same if each field is analysed separately and there is a wide gender gap in STEM programmes.

Basically in Latin America there are 8% of women who apply to STEM careers and then fail to get in. It is worth mentioning that, especially in the Latin American context, one of the barriers that women face once they enrol, and why many drop out, are family responsibilities (children, caring for family members, etc.). Furthermore, the data collected disproves the belief that there are innate gender differences in science. Although there must be continued efforts to recruit and retain women in these careers in order to further increase the percentage of women in STEM in both Latin America and Europe (García-Peñalvo, 2020).

#### Youth in confinement COVID 19:

In Latin America, the rise of studies on the youth phenomenon occurred at the end of the 1950s and during the 1960s, insofar as the social sciences "had to make the reality of youth a studyable phenomenon" (Feixa, 2006, p. 15). Hence, it is no small matter to review the fundamental characteristics of the Latin American generations, taking as a basis the historical and social processes of the region itself. In this way, youth cultures are affected by global processes, expanding cultural multi-identities that adopt socio-cultural practices from different latitudes, adapted to local cultures and realities. Many of these are represented by groups understood as "urban tribes". (Ramírez, 2020).

Feixa (2020) establishes the correlation between crisis and youth from a triple perspective.

Firstly, as youth in crisis, that is, the crisis appears as an independent variable, as the main cause of behaviours, perceptions and spontaneous or expert narratives that attribute to youth elements of instability, uncertainty, rupture and renewal. Secondly, as a crisis of youth, i.e. the crisis appears as a contributory variable, as a correlate of imaginaries, identities and counter-narratives that affect or emerge from youth in the form of protest and contestation of the established order, at the domestic level or in the public agora.

Thirdly, as youth of the crisis, that is, the crisis appears as a dependent variable, as an effect of historical conjunctures of stagnation and economic, social or political recession, which affect in a particularly intense way the new generations, due to their situation of vulnerability or the transience of their life trajectories (Feixa, 2020).

As the segment of society with the greatest digital skills, young people continue to be trapped by the interests that technological advances protect. The unlimited flow of information favours acculturation and the replacement of their referents and values. New ways of life and lifestyles are uncritically adopted by the new members of the global village. The personality traits of young people complicate their prospects for social insertion (Lazcano, Torres and Zepeda, 2021).

Regarding how youth experience the Covid 19 pandemic and the heterogeneity of youth groups, Domínguez points out: the COVID-19 pandemic exposes three main grievances shared by the majority of youth worldwide: a) the pandemic severely affects physical and mental health; b) the lost generation in which young people are projected will suffer the educational and economic consequences of the pandemic for a considerable time; and c) young people are systematically underrepresented in the debate on solutions to the pandemic. (Dominguez, 2021)

According to the results of the study conducted by González and Marín: confinement has not been the same for all students, it varies depending on their family and housing conditions, economic conditions and lifestyles. In addition, digital technologies have been essential spaces for entertainment, communication, socialisation and learning, as well as for being informed. Similarly, the pandemic has exacerbated student inequalities that pre-existed before the pandemic. These inequalities affect teaching and learning such as: access to technologies, constant communication, feedback, monitoring, management and skills of digital technologies, problem solving, to name a few aspects (Gonzalez and Marin, 2018). (González and Marin, 2018).

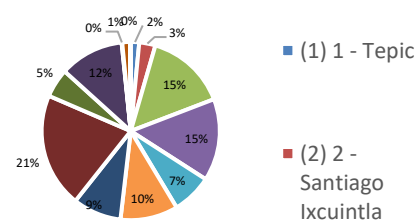
## Methodology

The School Violence Questionnaire-3 (CUVE3, CUVE3-EP, CUVE3-ESO) was used, adapted to the context of UAN's secondary schools, complemented with variables that also allow us to identify other elements such as students' perceptions of gender, interest in science and the use of new technologies, the use of free time, self-perception, information and violence through ICTs and the perception of young people in relation to COVID-19. In order to know the students' perception and due to the confinement in which we find ourselves worldwide, an online questionnaire was implemented and to achieve greater reliability, it was self-administered, with the aim of having the greatest certainty in the data. Of the total number of students surveyed, 48.39% were male and 51.61% female, with the majority being students in their first year of high school. For the purposes of this call for proposals, we will focus the results on the science, technology and covid-19 sections.

## Results

Distribution by age, gender, school grade. Of the total number of young people to whom the survey was applied, 13% were males in first grade, 21.93% in second grade and 8.77% in third grade, while females represented a greater number with 21.27%, 24.34% and 10.09% in first, second and third grades, respectively.

Thirteen of the 15 high schools of the Autonomous University of Nayarit participated: 21% in Villa Hidalgo, 15% in both Acaponeta and Tecuala, 12% in San Blas, 10% Compostela, in Ahuacatlán participation was 9%, Ixtlán del Río with 7% and Ruiz, Santiago Ixcuintla and high school 1 in Tepic with 5%, 3% and 2% respectively; having a percentage of less than 1% in high schools number 13 in Tepic, open high school and the one located in Puente de Camotlán.



**Graphic 1** Participation percentage

Source: Own elaboration based on the results obtained

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66.34% of the population who answered the questionnaire were women and 33.66% were men. In relation to age, only 3.4% of the women and 4.21% of the men were over 19 years of age, the rest ranged from 15 to 18 years of age. Students from all three grades also participated.

In relation to the type of family, 66.67% of women and 69.90% of men mentioned that they belonged to a mother-father family, 19.87% of women and 16.50% of men belonged to a family with only a mother, 1.31% of women and 1.29% of men belonged to a family with only a father; it is surprising that 0.49% of the girls mentioned living in a family with only a father. 49% of the girls mentioned living in a lesbian-parent family, and the same percentage of .33% of women and men with a same-parent family, almost 4% of the girls and boys mentioned living with grandmothers or grandfathers, approximately 3% live in another type of family (aunts, foster uncles, stepfamily, extended family) and, finally, 4.60% of women and 5.18% of men requested not to answer the question.

### *Self-perception*

Morales and Morales (2020), show the concept of self-concept, self-confidence and self-efficacy as follows: self-concept refers to an individual's assessment of himself/herself, self-confidence refers to his/her own conviction about a certain ability, and self-efficacy refers to its real fulfilment. In the STEM gap, such concepts explain that those who claim to be more capable in certain academic activities will tend to choose STEM careers.

Cited by García-Peñalvo (2020): Based on the Social Cognitive Career Theory (SCCT), some of the main factors that most influence are self-perception, self-efficacy, interest in science, expectations of results, previous educational experiences, family and social context, personal characteristics of the person and their goals when deciding which studies to pursue.

They also mention: Cited by (Morales and Morales, 2020) If there are students with higher self-confidence in scientific fields or have parents linked to these areas, they will be more likely to choose STEM careers; likewise, although women are unlikely to choose such careers, female students who showed similar levels of self-confidence were just as likely as male students to choose STEM careers (Moakler and Kim, 2014). According to Carrasco and Sánchez (2016), the main factors influencing women's decisions to study mathematics are self-efficacy recognition, liking the subject and teacher influence. Such evidence "exemplifies how what we believe we are and can do, that is, our identity, is defined collectively, based on our interactions with others and their perceptions of us" (Morales and Morales, 2020). (Morales and Morales, 2020)

Based on these concepts, students in Upper Secondary Education were asked about their self-perception. When asked about how introverted they considered themselves to be, the results, based on the total number of young people who responded, showed that only 30% considered themselves to be very introverted, while the majority of introversion levels were in the middle to lower half of their self-perception (Morales and Morales, 2020).

In the next scale, they were asked about how nervous they are, showing that young women show higher levels of nervousness from the mid-point onwards, compared to men. It is observed that almost 70% of the female respondents refer to themselves on the scale of 5 and above and of the total, just over 40% consider themselves on the scale of 7 to 10. In comparison with men, almost 55% of the total self-rated themselves as nervous on the scale of 5 and below, which may also be due to cultural factors, where men are considered to have higher levels of emotional control, so that the reinforcement of these social stereotypes begins at the adolescent age.

We then asked them about their perception of happiness, with similar data for both women and men, finding that almost 80% of the young people consider themselves to be at levels on the 8 to 10 scale.

In the next scale of measurement, we asked how valuable they consider themselves to be. Young women have a higher level of self-perceived self-worth, while men, at the highest level, decrease by almost 10 per cent.

When students are asked how sensitive they consider themselves to be, once again the socio-cultural factors associated with the sex of each young person can be emphasised, because women continue to have higher levels than men, for example, based on the total sample, more than 80% of women consider themselves to be sensitive at levels five and above, while men, with a similar scale of measurement, represent only approximately 45%.

When asked about how extroverted they are, the results are very similar, with men and women, based on the total sample, showing percentages of almost 70%.

When asked about their self-perception of security, the results again diverge by almost ten points, with approximately 25% of women feeling secure at levels five and above, and almost 85% of men feeling secure at the same level.

They were also asked about how sad they consider themselves to be, with the result that at least 30 per cent of women have a sadness level of six and above, and almost 20 per cent of men, based on the total sample, which is also a condition often marked by gender.

Similarly, they were asked about how insignificant they consider themselves to be, the results refer to the levels obtained in the previous graph, with women presenting higher levels of self-perception compared to men, with almost a 5% difference based on the total sample, i.e., almost 25% of women refer to levels of five and above and approximately 20% of men.

It should be mentioned that these results were collected during the first stage of confinement, which could vary, say at a pre-pandemic stage.

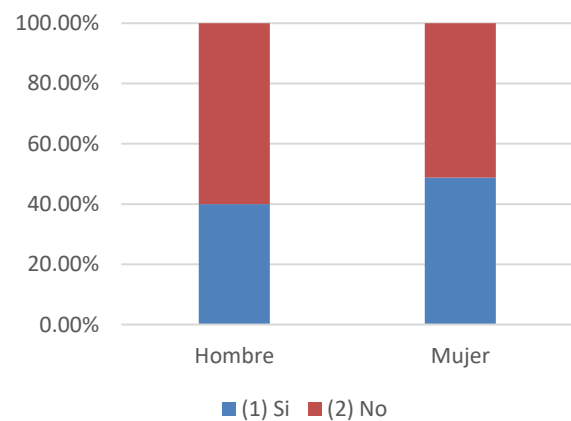
*Gender, science and technology*

One way to encourage women to pursue STEM studies is to model successful women in STEM fields (Lockwood, 2006). It is increasingly accepted that female role models are effective in inspiring girls, such as the National Academy of Science books and "Women's Adventures in Science" (Cheryan et al., 2011) (Oliveros, Cabrera, Valdez & Schorr. 2016).

According to Morales and Morales (2020), for decades, the under-representation of women in STEM careers has occurred for various reasons: prejudice, discrimination, stereotypes, sexism, supposed incapacities or essentially male scientific structures (Fausto-Sterling, 1981). Today, this situation continues. According to Botella, Rueda, López-Iñesta and Marzal (2019), women in STEM careers still face multiple barriers and challenges at different stages of their professional development: lack of mentors, absence of female role models, unequal opportunities, gender bias and wage gaps barriers that show diverse impacts and their solution "would require the action of several actors and institutions to achieve a real change towards a gender-sensitive culture".

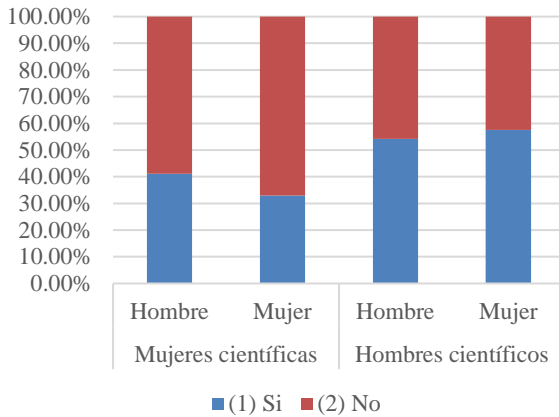
The students of Higher Secondary Education at the Autonomous University of Nayarit were asked about the elements that could account for their enjoyment of learning, science and other activities focused on knowledge generation.

Regarding interest in science classes, women mentioned a mostly positive response with 48.72% compared to men with a 40% affirmative response.



**Graphic 2** According to sex and liking for science classes  
*Source: Own elaboration according to the results obtained*

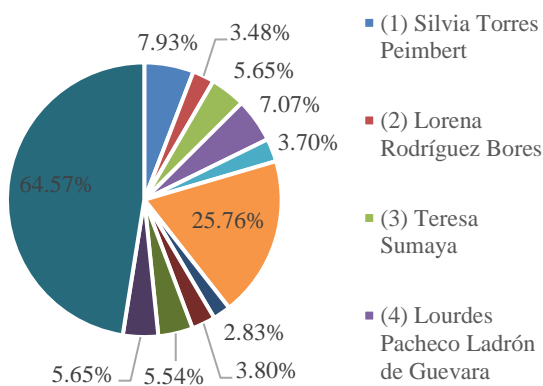
Regarding knowledge of male and/or female scientists, 58.9% of men and 67.09% of women answered that they did NOT know female scientists, while, with respect to knowledge of male scientists, the response was positive 54.17% of men and 57.70% of women who said they knew any.



**Graphic 3** According to knowledge of female and male scientists

Source: Own elaboration according to the results obtained

They were asked if they knew any person in the scientific environment, selecting from a list those people they had heard of.



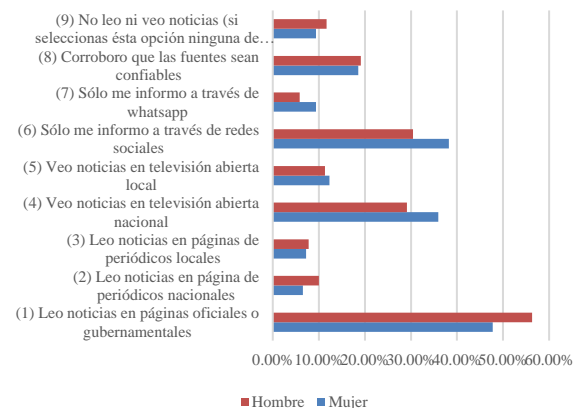
**Graphic 4** According to knowledge of scientific personalities

Source: Own elaboration according to the results obtained

It is worth mentioning that the survey was carried out in the semester in which the entrance to the confinement began and that is why 25.76% mainly mention Hugo López-Gatell Ramírez as the man most mentioned by all the national media, however, 64.57% say they do not know any scientific person.

Information and ICTs

During the research process we lived through the first stage of the COVID-19 pandemic, it was considered important to identify access to information, use and availability of technologies, for which young people were asked to select the way in which they kept themselves informed during the contingency. 47% and 56.31%) of young people mentioned that they read news on official or governmental websites; 38.26% of women and 30.42% of men mentioned being informed through social networks; 35.96% of women and 29.13% of men watch the news on open television and 9.36% of young women and 11.65% of men do not read or watch news anywhere. This indicates that both genders keep themselves informed.



**Graphic 5** According to staying informed on contingency

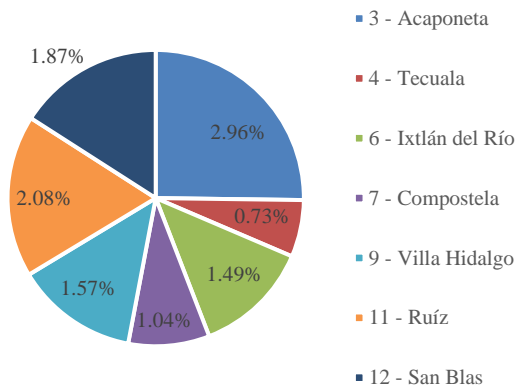
Source: Own elaboration according to the results obtained

COVID-19 and youth

As Sierra (2020) mentions, an unprepared vulnerability took hold among the people and the discourse of fear took over public and private life. By mid-March, the phenomenon had already become the main concern of a large part of the population, and conversations revolved around the COVID as the backbone of everyday life at the time. The arrival of the pandemic revealed, as D. Harvey (2020) points out, a lack of preparedness on the part of the authorities and public opinion to deal with a health crisis of this magnitude. (Sierra, 2020).

The confinement led to changes in social practices and in this sense, among university youth in Higher Secondary Education it was found that 32.35% of women and 27.18% of men mentioned that only one or two people go out to make purchases, payments, etc., 29.39% of women and 25.24% of men said that they were at home and, in third option, 26.44% of women and 27.18% of men mentioned that some people from home go out to work.

The Academic Units that present abandonment due to the COVID-19 pandemic are: Acaponeta, Ruíz, San Blas, Villa Hidalgo, Ixtlán del Río, Compostela and Tecuala, these are mentioned from highest to lowest percentage.



**Graphic 6** Academic Units with the highest dropout rates  
 Source: Own elaboration according to the results obtained

Of course, the confinement brought with it some physical and emotional afflictions, the main ones being that 54.68% of the students mentioned changes in sleeping schedules, 44.17% reported an increase in their level of stress, 37.69% felt sad, 36.12% had more headaches, 35.30% reported that they got angry more easily, 33.83% slept more and 31.53% mentioned feeling depressed. Of the young people, 42.72% mentioned changes in sleeping schedules, 29.77% increased stress, 26.21% slept more, 25.57% slept less, 24.71% got angry more easily, 24.60% felt sad and 24.27% reported greater difficulty concentrating. The table below shows the young people's responses. In addition to the stress caused by the lack of exercise, confinement also leads to joint pain.

**Conclusions**

History demonstrates the silencing of women and their exclusion from science and technology, a motive that has permeated over the years to reverse patriarchal domination. Gender biases remain from the beginning of school until the end of school, as well as in the family environment and the media. In the application of the instrument, the majority of the participants were women, who mentioned their interest in science lessons. A high percentage have a smartphone that they use for social and school activities, mentioning that they share a computer or tablet with family members. Their main source of information is through social networks and/or official government websites and the latter due to the pandemic. Emphasising that the response is given at the time of the first stage of COVID-19 where the information of the confinement becomes viral through different messages on television, WhatsApp, Facebook, presenting itself in the form of news or memes.

However, they are fortuitous moments where interest in science and technology is evident in the media, contrasting the above information, 40% do not have access to the Internet which makes it difficult to access information and teaching that is currently taught online or at a distance, which is transferred to the response of the lack of knowledge of women and men of science. The confinement impacted their lives in terms of social practices, economics, health and school drop-out, the latter in 7 academic units. Not to mention the physical afflictions in which the majority of the population is embedded.

While the evidence of women in science is not in dispute, as well as young women scientists, science has not been able to achieve equality. We are going through extraordinary times, where it has been shown that through the dissemination of science on accessible platforms, youth and specifically women can be reached. The challenge is to change the mechanisms of exclusion, to break down myths and gender stereotypes, to recover the voice of women scientists, to make them visible and to put feminist research at the centre.



We propose to bring the women scientists of the Autonomous University of Nayarit closer to the student body, to get to know their life story through dissemination and technology, which is the current and effective connection with young people, to increase equal participation in the classroom, to use female theorists in the study programmes in order to get to know them and turn them into an inspiration; to make the STEM careers offered by the university known in secondary schools, on the other hand, that science programmes and/or science camps do not depend on grades or marks, but on the curiosity and motivation of young university girls, as there is evidence that after the first science camp or summer, the interest in choosing a university career linked to a STEM career is born, thus contributing to breaking down gender stereotypes and reaching the longed-for equality in science.

Due to the pandemic caused by the covid-19 virus and the problems faced by the different young people in Secondary and Higher Education, it will be a challenge to create gender equality actions, however, it is proposed to create short and long term objectives in which media campaigns are carried out with female students aimed at the student community in which results and experiences obtained in Scientific Research Summers are promoted, as well as the Explora Programme focused on the population of Secondary and Higher Education.

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