Challenges of Female Scientists at the Universidad Central "Marta Abreu" Las Villas

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— *Abstract*—

This research was carried out at the "Marta Abreu" Central University of Las Villas with women scientists of different ages. General objective: Diagnose the needs and potential of women researchers at the "Marta Abreu" Central University of Las Villas through an interpretive case study. The research methods and techniques are document analysis, participant observation, researcher diary, in-depth interviews, activity reports, and role plays. For this purpose, it had 4 units of study according to the ages of the participants. In turn, the research has 3 phases: pre-active, interactive, and post-active. Artificial intelligence (AI) was used to determine categories and subcategories as a specialist criterion to efficiently measure the research and find theoretical links in the scenario. They threw themselves into the following regularities: Cuban women have a social-historical context that facilitates their professional development although they recognize obstacles in the family and economic environment that delayed their professional development. Middle-aged female scientists suffer the dilemma of family consolidation and the development of full motherhood and the academic training of women scientists has an imbalance between the exact and humanistic sciences, opting for the latter in the vast majority.

Keywords:
Female scientist; case study; artificial intelligence

The difference between men and women in science is present to a small or large extent throughout the entire social and work environment. The role of Cuban female researchers, on the other hand, does not have this distinction, since the biological difference does not affect the intellect. Gender is not a barrier to collaboration and mutual support in a variety of projects. However, women are also mothers and daughters. A fruitful career and successful research projects require your undivided attention and care, leaving little or nothing for parenting. This is how family development hinders research development.

As for age, the most successful researchers indeed come from experience and systematic education, and promising young women lack the same research skills, but we should not think that this is something unrelated to gender, young people, in general, have to work twice as hard to receive the same recognition.

Artificial Intelligence (AI) is a powerful tool in the scientific production of society. The female researcher in Cuba is allowed access to the available information and the laws are applied to her as to any male researcher. Women receive active protection from their work or social circle, both consciously on the part of the state and unconsciously on the part of their male colleagues.

With VOSviewer software, a bibliometric analysis (Figure 1) was carried out with the Dimensions database over 10 years, with journals indexed in the Scopus database. This showed the most recurrent investigations, such as those related to health, identity, and legality. While the education and training of a female researcher from an early age is insufficient.
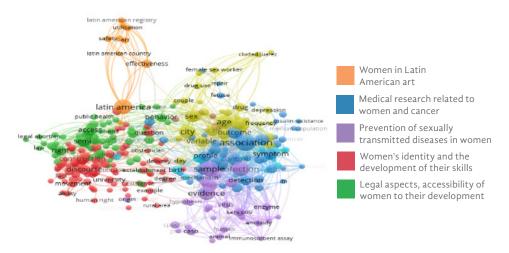

Figure 1. Bibliometric analysis of research conducted by women in Cuba

Different methods and techniques were applied at the Universidad Central "Marta Abreu" de Las Villas with female scientists of different ages through a case study, which yielded the following information:

- Insufficient preparation of women scientists in AI to determine categories.
- There is a cognitive bias concerning AIs, evidenced by the type of question.
- Girls are educated under a patriarchal regime that limits them at home to pre-established role-playing as "girls."
- There is a tendency toward consumerism and superficiality with unattainable beauty standards for Latina women and future researchers.
- Underrepresented in degrees such as engineering.
- Women are self-limited by their role as mothers and daughters in terms of participation and representation in management and administrative positions.
- Female scientists over 60 years have the role of caregivers of elderly parents and younger children, which makes it difficult for them to play a leading role.

The general objective of this research was to diagnose the needs and potentialities of women scientists at the Universidad Central "Marta Abreu" de Las Villas, through an interpretative case study.

METHODOLOGY

IThe path followed in the research is qualitative, the course of a participatory-action-research based on the following:

> It is based on the notion of a self-reflection spiral of cycles of planning, action, observation, and reflection, with an interpretive case study. With three phases: pre-active, interactive, and post-active. It expresses a commitment to the improvement of practices and is collaborative (Creswell et al., 2007).

The study corresponds to qualitative research of a transformative and evaluative nature, taking into account the interconnection established between the epistemological and methodological processes, where the subjectivities of the participants in the contextualized practice and the qualification of the data that emerge from the different stages of the research process itself are taken into account. The following research methods and techniques were used:

- o Document analysis, aimed at assessing the theoretical links and regularities of female researchers.

o   Participant observation, to collect data in the scenario for future girls researchers, families, teachers, and Chat GPT. It allows the recording of the data obtained from the observations made in a systematic way, focusing on the categories and subcategories emanating from the first stage.
o   The researcher's journal collects detailed qualitative data at each of the investigation stages.
o   In-depth interviews with women and men who study science at university, teachers, and Chat GPT to collect enough information about their needs and potential; according to the established units of analysis.
o   Product of the activity and role plays with the future female researchers.

The researcher simply seeks to become familiar with the nature and scope of the area under study and is oriented towards achieving a basic knowledge of the phenomenon, as well as the fundamental issues and problems involved in it. Participants were selected, units of analysis were determined, and categories and subcategories were designed with the use of artificial intelligence.

Four units of analysis were taken into account to carry out this research:

First unit of analysis: five girls between 10 and 17 years old, who are contestants in subjects such as mathematics and physics at the provincial level, relatives of the authors of this research, which allowed the data to be taken on stage.

Second unit of analysis: six young girls between 17 and 25 years old, students and recent graduates of the degrees of economic sciences of the Universidad Marta Abreu de Las Villas, five women, and one man hold a gold title, with an academic index of five points; three titles to scientific merit that are awarded to students who participate in national and international events and publish their scientific results in indexed journals.

Third unit of analysis: six female researchers between the ages of 30 and 50 of whom one has a bachelor's degree, four have a master's, and one a doctorate degree, all professors at the Universidad Marta Abreu de Las Villas.

Fourth unit of analysis: five female researchers between 50 and 75 years old, all with a doctorate, degree coordinators, managing international projects, editors, and judges of indexed journals; scientists recognized in their branch nationally and internationally.

DEVELOPMENT

Pre-Active Phase

This phase takes into account the preconceptions about the research topic, the previous information, the intended objectives, the case selection criteria, and the influences of interactions of the context; the materials, resources, and techniques are determined.

To collect the data in the scenario, three researchers from the age groups of the analysis units were selected. A study of the categories and subcategories was done for this research. With this in mind, the use of artificial intelligence is a specialist criterion.

ChatGPT is a language model developed by OpenAI that uses natural language processing techniques to generate coherent and natural responses in real-time and has been trained on a wide variety of tasks. This system is an artificial intelligence that has been having a huge impact on society since mid-December 2022, and it seems that it will continue in the short and medium term. Faced with this circumstance, as researchers, we must find ways to incorporate this AI into our research routines (Lopezosa & Codina, 2023).

The objective of the stage was to determine categories and subcategories with the use of AI as a specialist criterion to efficiently measure research, as well as find theoretical links in the scenario.

The methods and techniques applied were document analysis and in-depth interviews with women and AI.

The needs that arose were:

- Insufficient AI preparation to determine categories.
- Cognitive bias concerning AI, which is evidenced by the type of question.
- Connectivity needs.

The potential was:

- Female researchers are committed to studying and analyzing their reality.
- Extensive information search.

The contextual category and subcategory of female researchers were:

a) Historical and social context of female scientists. This refers to the analysis of the conditions, challenges, opportunities, and contribu-

tions of female scientists in different times and places, as well as their relationships with gender, culture, politics, and the economy.
b) The academic and professional trajectory of female scientists. This subcategory refers to the analysis of the factors that influence the access, permanence, development, and recognition of female scientists in the educational and labor fields.

The category and procedural subcategories of female researchers were:

a) Challenges and opportunities for women in academia and research. It explores the barriers and benefits women face in academia and science, such as discrimination, harassment, the pay gap, family balance, access to resources, recognition, and leadership.
b) Participation and representation of women in academia and research. Here we analyze the percentage and profile of women engaged in science and higher education, as well as their distribution by areas and levels.
c) Training and development of women in academia and research. Here we study the factors that influence women's choice and performance in scientific and academic degrees, such as education, guidance, motivation, creativity, innovation, and collaboration.

The attitudinal category and subcategories of female researchers were:

a) Intellectual curiosity and restlessness. It was measured by the desire to learn, explore, discover, and understand the world and its phenomena, as well as to solve scientific problems, challenges, and enigmas.
b) Vocation and personal satisfaction. The feeling that science is the activity that most closely matches personal skills, tastes, and values, as well as the source of fulfillment, pleasure, and well-being, was analyzed.
c) Recognition and prestige. Appreciation, respect, and admiration of peers, institutions, and society for the scientific work carried out, as well as access to opportunities for professional and academic development, were taken into account.

This interaction with AI allowed the researchers to excel in areas not sufficiently addressed so far.

Interactive Phase

In this phase, the data was obtained according to the units of analysis of the future researchers within the family from 2022-2023.

First unit of analysis: five girls between 10 and 17 years old, who aspire to become researchers.

The methods and techniques applied were: document analysis, in-depth interviews, and participant observation. The objective of the stage was to measure categories and subcategories emanating from the previous stage and reach partial conclusions.

The needs arising from the observation of the girls were:

- Girls are educated under a patriarchal regime that limits them at home to pre-established role-playing as "girls."
- Young women are hindered in love relationships compared to the male gender and are stimulated to improve.

The potential emanating from the observation of the girls were:

- Girls are stimulated to communicate their feelings: "They can cry"; manifestations that are forbidden to boys, which will influence them to opt for humanities degrees in adulthood, being insufficient in engineering careers.
- They are stimulated to perform household chores which will allow them to validate themselves in adulthood.
- Women present a social burden in overcoming the feeling of "standing out" to men in terms of knowledge.
- Society insists on the idea of "you have to be somebody" which exerts psychological pressure to excel.

Characterization of the social-historical context of women researchers at the Universidad Central "Marta Abreu" de Las Villas, Villa Clara, Cuba 2023:

The Universidad Central "Marta Abreu" de Las Villas is a public university located in Santa Clara, Cuba, inaugurated on November 30, 1952. The university demonstrates its category of excellence by being positioned as the number one university in Cuba and the 240th in Latin America in the Universities Web Ranking. It currently has 12 faculties and more than 50 undergraduate programs. It has 7 active diploma programs, 30 training programs, 519 postgraduate courses, 43 master's degrees, 4 postgraduate specialties, and 20 doctorate degrees. Of

the total number of participants, 7700 are women, which is 55.7% (Calderón, 2022). This is evidence of the prominence of women in science.

Second unit of analysis: Six young women between the ages of 17 and 25. The needs that emerged from the in-depth interviews with teachers were:

- In the social sphere, they perceive verbal violence towards women, devaluing them, which is not the case in the university environment. Gender-based violence against women in Cuba is related to the patriarchal Cuban cultures of specific geographic spaces. There are few publications in Cuba on gender issues, it is possible to identify the phenomenon of invisibility of the already existing and recognized feminist academics in the rest of the universities and scientific institutions of the country (Hernández, 2019).
- There is a tendency to consumerism and superficiality with unattainable beauty standards for the Latina woman and future researcher:

The importance of fashion in Cuban society and its role as a distributor and creator of social content and modern consumer images at the same time evidences the rational and gender tensions that are transferred to changes in aesthetic models and good taste (...) Lesbia Soravilla criticizes the frivolity of this mass and consumer culture that enslaves women as objects of Cuban consumption subjected to an international market (Ruiz, 2013).

- Underrepresented in degrees such as engineering. In science, progress toward gender equality cannot be taken for granted. Progress is being made on the issue of discrimination, but women still cannot fully develop in a scientific career on an equal footing with men. Science and engineering are professions that show less progress toward gender equality than other highly skilled professions, such as lawyers and doctors (Peláiz, 2020).
- They consciously sacrifice their recreation because they possess high metacognitions. They are capable of projecting themselves in time as future researchers.

The potential observed from the in-depth interviews were:

- In our country, they are exempted from compulsory military service, which they consider an advantage over men of the same age.
- They have the same equal rights and duties in the university environment, being leaders in youth organizations:

The results show that women in Cuba face several barriers that restrict their political participation, such as limited access to political information and lower confidence in their political abilities, compounded by limited social support and the prevalence of political coercion. (Vara, 2023)

Third unit of analysis: Six female researchers aged 30 to 50 years.
The needs that emerged from the in-depth interviews with teachers were:

- As for participation and representation in management and administrative positions, they are self-limited by the role of mothers and daughters:

Women may face a more limited social support environment in terms of encouraging and promoting their political participation. Gender discrimination and traditional gender norms can lead to a lack of social support for women's political participation. (Vara, 2023)

- These women feel that motherhood can affect their professional performance, since:

In Cuba, 13% of births occur in teen mothers who should be dedicated to studying and preparing for life, so teenage pregnancy is a social phenomenon of high proportions. (Cortés et al., 2015)

Therefore, women scientists in many cases delay motherhood for fear that their career may be affected, using contraceptive methods as part of family planning, which could lead to sterility problems and, in turn, contribute to the low birth rate in the country. Taking into account that:

Procreation and having offspring have meanings for women, it is usually synonymous with the development of their maternal function, protection, affection, and education; while for men it tends to have a meaning more aimed at feelings of power, patriarchy, protection, and provide. Beyond biological reproduction, it is social reproduction and the spaces where it occurs that ultimately determine individual and collective perceptions of reproductive function and infertility. (Díaz Bernal & García Jordá, 2010)

The potentialities emanating from the in-depth interviews are:

- Women perceive that they have equal opportunities in research and are valued by their male co-workers.

- They have equal economic and social remuneration for the work they do.
- They are competent women and are emotionally satisfied, as they have reached their professional goals at a young age.

Fourth unit of analysis: Five female researchers between 50 and 75 years old.

This age group is the most represented in the country. Active aging recognizes factors and sectors and implies continuity in socially productive activities and rewarding work. It is determined by different factors. Social factors: Education, human rights, social support, among others. Personal factors: Biology and genetics, adaptability, health, and social services. Factors of the physical environment: Urban and rural areas, housing, injury prevention. Economic factors: Income, work, social protection. Behavioral factors: Physical activity, healthy eating, smoking cessation, among others. (Kindelan & Valle, 2019).

The needs that emerged from the in-depth interviews with teachers were:

- They have the role of caregivers of elderly parents and minor children. Which hinders their spotlight.

Not infrequently, women find important scenarios of social and professional development, but they maintain an internal contradiction between the public and the private due to the leading role they play in the care of children, the sick, and the elderly in the family environment, so they must continue advancing to achieve a more leading role in the field of decision making. (Díaz et al., 2017)

- They are not sufficiently accompanied by their husbands to carry out household chores in an equitable manner, which would allow for greater professional development.

DISCUSSION

Post-active Phase

We drafted the discussion from the initial report, recorded and transcribed the discussion interview of the initial report, and after its analysis, the final report and the critical reflection on the results were written. Cuban women have a historical and social context that facilitates their professional development. They have participated in educational improvement due to the socialist process in Cuba, which enhanced culture and raised the educational level since the country provides free and quality education.

These women are encouraged in the workplace and their community context, being awarded for their professional performance.

The women surveyed recognized obstacles in the social and economic spheres that affected or slowed their professional development. They have had an emotional intelligence that has allowed them to face these difficulties and obtain the scientific and teaching categories they expected.

Middle-aged women scientists were faced with the dilemma of family consolidation and the development of full motherhood.

They are undisputed leaders in their work environment, performing under equal conditions, salaries, and opportunities as men.

In the academic training of female scientists, there is an imbalance between the exact and humanistic sciences, with the vast majority opting for the latter.

The female researchers were artificially prepared for the realization of this research, feeling motivated to use them for future research.

CONCLUSIONS

Analyzing the background and theoretical research on female scientists, first of all, it was appreciated how there are challenges for them that are currently unresolved. The study carried out revealed, with the use of artificial intelligence, the categories and subcategories that were taken into account to carry out the research at the Universidad Central "Marta Abreu" de Las Villas.

In the results of the studies carried out in the field of scientific women, units of analysis were determined that made it possible to analyze the data in the scenario and to carry out an interpretative case study at the Universidad Central "Marta Abreu" de Las Villas.

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