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STRATEGIES TO PROMOTE THE PARTICIPATION OF THE STEM MODEL WITH GENDER EQUITY IN TECNM ROQUE

STRATEGIES TO ENCOURAGE PARTICIPATION OF THE GENDER-EQUITABLE STEM MODEL IN TECNM ROQUE

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Abstract - This article seeks to document a learning approach through research and experimentation, motivating the student to discover, reach conclusions and design methods to execute what has been researched.
Teaching in context, to be true to the meta-disciplinary concept of STEM methodology for Tech. If you do not teach in context, you are simply teaching science or mathematics in isolation.
The aim is to improve the retention of the concepts learned, and to promote them in relation to decision making for the formation of researchers and leaders with decision-making skills to meet the challenges of an increasingly advanced society.
By proposing an improvement strategy and skills development to foster gender equitable participation of the learning model skills development and identifying strategies to foster gender equitable participation of the STEM learning model at TecNM Roque seeks to counteract the negative self-perception that women may have in relation to the disciplines.

Keywords: Education, gender equity, learning strategies, Higher Education, gender , STEM.

Abstract -- This article seeks to document a learning proposal through through research and experimentation, motivating the student to discover, reach conclusions and design methods to execute what has been investigated. Teaching in context, to be faithful to the meta- disciplinary concept of the STEM methodology for Technologists. If it is not taught in context, we would simply be teaching science or mathematics in isolation.
The aim is to improve the retention of the concepts learned, its promotion in relation to decision making is important for the training of researchers and leaders with problem-solving skills in the face of the challenges of an increasingly advanced society.
By proposing an improvement strategy and the development of skills to promote equitable gender participation in the skill development learning model and identifying strategies to promote equitable gender participation in the STEM learning model at TecNM Roque, we seek to counteract the negative perception of themselves that women can have in relation to the disciplines.

Key words - Education, gender equality, gender perspective, higher level, learning strategies, STEM.

INTRODUCTION

Establish a parameter that improves the conditions and interdisciplinary integration of engineering areas in an associated context in engineering and technology, identifying the concepts as the collaborative economy for the resolution of problems and in function to the optimization of resources and its application to the real world through the analysis of situations that affect the day to day and the implementation of resolutive innovation. The intention is to develop strategies that help promote creativity in favor of the increase and capabilities for problem solving from an equitable gender perspective based on the STEM learning model.
The labor situation in the state of Guanajuato. The Economically Active Population (EAP), that is to say, the

The number of people who were employed or unemployed in the week prior to the interview was 2.8 million in the second quarter of 2021 for the state of Guanajuato, 116 thousand people more than in the previous period. The division by sex in the male EAP was 1.7 million, 30 thousand people more, and the female EAP was 1.1 million, 86 thousand more than the amount recorded in the first quarter of 2021.

The economic participation rate in the second quarter of 2021 was 60.1% of the working-age population, 1.9 percentage points higher than in the first quarter of 2021. The economic participation rate for men was 77.7% and for women 44.9%, 1.5 and 2.6 percentage points higher, respectively, compared to the previous quarter.

An increase of 116 thousand people in the Economically Active Population (EAP), from 2.7 million to 2.8 million people. The employed population was
2.6 million people, reporting increase of 118 thousand.

The number of people employed in tertiary activities increased by 65 thousand, with the greatest impact in the commerce sector with an increase of 34 thousand and in the professional, financial and corporate services sector with 15 thousand people.

The number of people employed in micro-businesses increased by 61 thousand, specifically, in those that have an establishment to operate, with 56 thousand more people. The underemployed population decreased by 23 thousand people, from 452 to 429 thousand. The unemployment rate decreased 0.3 percentage points from 5.9% to 5.6% at the state level.

DEVELOPMENT

THE STEM MODEL

The acronym STEM is a Role Model: The strategy proposed by Stout (2011), titled "*STEMing the Tide: Using Ingroup Experts to Inoculate Women's Self-Concept in Science, Technology, Engineering, and Mathematics (STEM)*," refers to the academic disciplines of Science, Technology, Engineering, and Mathematics.(Caceres, 2019).

This term has become popular in education and the workplace to describe an integrated approach that promotes interdisciplinarity and the application of skills and knowledge in these areas.

STEM Science, Technology, Engineering and Mathematics, these areas of knowledge are often grouped under the term STEM because of their interrelatedness and importance in complex problem solving and technological advancement.

A brief explanation of the contribution that STEM education makes; it fosters critical thinking, problem solving, and problems and creativity, strives to close gender and diversity gaps in these areas by encouraging the equal participation of all students.

National Science Foundation (NSF); The U.S. NSF has endorsed the integration of STEM disciplines. Its report "Reimagining the Role of Technology in Education: 2017 National Education Technology Plan Update" highlights the importance of STEM education and how it can prepare students for the challenges of the 21st century.

"STEM Integration in K-12 Education; Status, Prospects, and an Agenda for Research" from National Academies Press addresses the integration of STEM in K-12 education, highlighting its relevance to the preparation of students in the critical areas of science and technology.

AAAS has advocated for STEM education and has published numerous reports and resources, including "*Vision and Change in Undergraduate Biology Education: A Call to Action*," which highlights the importance of STEM education in biology and beyond.

Strategies to promote equitable gender participation in education, especially in STEM disciplines, have been based on various research and theories, of which we will mention a few.

This strategy focuses on the introduction and promotion of successful and experienced female role models in STEM fields, with the aim of strengthening the self-image of women in these areas. The idea is to use the presence and achievements of women leaders in STEM as a means to challenge gender stereotypes and motivate other women to consider and actively participate in these disciplines. This approach is based on the premise that identification with female role models can have a positive impact on women's confidence and perception of their ability to excel in engineering careers.

GENDER-EQUITABLE

The Tecnológico Nacional de México is an institution with 254 branches throughout the Mexican Republic, dedicated to training quality students, committed to the development of the country.

TecNM-Roque, an institute with 97 years of history that has changed its name over the years and today belongs to the TecNM system, located in the municipality of Celaya, Gto.

Currently there is an enrollment of 2,600 students in six educational programs: Engineering in Business Management, Engineering in Food Industries, Engineering in Agronomy, Engineering in Sustainable Agricultural Innovation, Engineering in Hydrology, Engineering in Information and Communication Technologies. In terms of gender, 52% are men and 48% are women, graduating professionals with the following profiles

in the agro-industrial areas and from 36 localities, 12 urban and 24 rural (TecNM Roque, 2023).

A gender represents the integration into a social system, where roles are assigned, the term gender (*from the Latin genus, -eris*) is a set of beings that have one or more common, differentiated characters based on various divisions according to gender. An example is the assignment of a masculine and feminine gender based on the sexual division of productive and reproductive labor. This imposes personality attributes or stereotypes to be followed for both the male and female genders, determining spaces for the development of activities and interests and hierarchical or prestige valuations. The genders tend to perform external public activities in social life; work, politics, development spaces and activities of an internal nature, such as domestic life, reproduction, and care of others.

In this regard, created in 2001, the National Women's Institute (INMUJERES), has had the good will to "*promote and foster the conditions that make possible non-discrimination, equal opportunities and treatment between genders; the full exercise of all women's rights and their equal participation in the political, cultural, economic and social life of the country, and among its specific objectives is the execution of the policy of permanent coordination between the agencies and entities of the Federal Public Administration, as well as state and municipal authorities in relation to women*". (www.gob.mx/inmujeres , 2023).

Continuing with the inclusion of women UNICEF Mexico (2023) mentions that women, girls and adolescents in the field of science and technology "central to the sustainable development of Mexico" have been historically and systematically underrepresented in Mexico and the world the study of science, technology, engineering and mathematics.

Currently in the world only 35% of women study related careers; in Mexico, the figure 38%, slightly higher, but not significantly, especially if we consider that these disciplines are in greater demand and offer better salaries at the national level (IMCO, 2021).

On the other hand, access to new technologies without adequate protection policies results in greater risks for women, girls and adolescents: among those over 12 years of age, nine million have suffered cyberstalking in the country, with higher levels of exposure among adolescents and younger girls. Sexual advances and propositions (36%) are the most frequent situations (INMUJERES, 2022).

This points out that promoting equal educational and professional opportunities, with a special focus on girls and adolescents, is a fair process, in matters of of rights, and essential for the construction of an educated and productive Mexican society, free of poverty and in which the entire population can count on full fulfillment of its rights from birth to adulthood. (www.unicef.org, 2023).

MATERIALS AND METHODS

This study will follow a non-experimental mixed research approach that evaluates growth and development within agricultural production systems, applying technology and skill development tools and identifying strategies to foster gender equitable participation of the STEM learning model at TecNM Roque.

The object of study includes dividing with gender equitable, among female students who are engaged in the productive chain, contemplating seven branches, for effect qualitative and quantitative approaches will be used to collect information to promote gender equitable participation of STEM learning model in TecNM Roque.

From the beginning, the study implies establishing a characterization of the research subjects based on predetermined variables that should be established in the first stage of the project.

Within this first stage, for the purposes of the study, two techniques will be used to gather information on the production systems previously mentioned, using semi-structured questionnaires, discussion groups and in-depth interviews.

In this case, the research team will collect information through observation, when the participants do not agree to be recorded. In parallel, surveys will be conducted to assess their level of growth and development in their daily lives.

The strategies to be proposed will be based on the following four aspects:

a. Inclusive Environments Strategy: The Inclusive Environments strategy, as proposed by Hurtado (1998), focuses on improving academic environments to foster racial and ethnic diversity. The central objective of this strategy is to overcome barriers associated with diversity by creating educational policies and practices that promote a welcoming and equitable university environment for all students, regardless of their ethnic background. According to the research, creating a campus that celebrates and respects diversity contributes to improved student retention and achievement. The underlying premise is that an inclusive environment promotes a more enriching and just educational culture, which, in turn, fosters equitable participation for all students.

b. Early Education and Socialization Focus Strategy: The Early Education and Socialization Focus Strategy, as proposed by Eccles (2009), is oriented toward the influence of early experiences and socialization on students' attitudes and decisions. The core of this strategy lies in understanding and addressing how gendered social expectations, established early in life, affect educational and career choices. According to the research, recognizing and counteracting these influences from childhood can be critical to fostering gender-equitable participation in areas such as STEM disciplines. The underlying premise is that addressing early socialization can contribute to the creation of a more inclusive and equitable educational environment.
c. Active and Participative Learning Strategy: The strategy that focuses on Active and Participative Learning, as proposed by Freeman et al. (2014), is based on the implementation of pedagogical methods that encourage the active and collaborative participation of students. The essence of this strategy is to use teaching approaches that go beyond the traditional transmission of knowledge, providing opportunities for students to be actively involved in the learning process. According to the research, the introduction these active pedagogical practices improves student achievement in science, engineering and mathematics. The central idea is that an educational approach that encourages active participation can contribute to equity and positive student achievement in STEM disciplines.
d. Mentoring and Support Network Development Strategy: The strategy that addresses Mentoring and Support Network Development, as proposed by Handelsman et al. (2005), focuses on the implementation of mentoring and networking programs. The essence of this strategy lies in the introduction of seminars and programs designed to train and support those who are taking their first steps in the scientific field.

Objectives

To identify the participation of the STEM learning model in TecNM Roque students and to design strategies for gender-equitable growth and development of the model.

- Assess the current status of gender participation in STEM programs at TecNM - ROQUE.
- Identify barriers to equitable gender participation.
- Design specific strategies that promote equal participation and design gender-equitable strategies of the STEM learning model for TecNM - ROQUE.

Hypothesis

Measuring growth and development with a gender-equitable STEM (Science, Technology, Engineering and Mathematics) test focused on science, technology, engineering and mathematics will significantly influence and increase student participation at TecNM Roque.

Variables

1. Gender Stereotyping. Suggests that cultural and social stereotypes may influence people's educational and career choices. Eagly & Steffen (1984) note that these stereotypes may be rooted in the traditional distribution of gender roles in society. In the context of the research, this theory supports the idea that gender stereotypes may be contributing to the disparity in participation in STEM programs.
2. Inclusive Environment. Argues that creating an inclusive and welcoming educational environment is essential to overcoming gender barriers. Hurtado et al. (1998) argue that a diverse and welcoming campus improves the retention and achievement of students belonging to marginalized groups. This theory supports the importance of designing strategies that promote an inclusive STEM environment at TecNM - ROQUE.
3. The Role of Role Models. Highlights the positive influence of female role models in STEM fields. It is suggested that the presence of female role models can improve the self-image and expectations of women in these disciplines. This theory supports the importance of promoting female role models in the educational context of TecNM - ROQUE.
4. Gender Socialization in Education. It highlights how socialization experiences from early ages can influence students' attitudes and expectations. Eccles & Wigfield (2009) argue that gendered social expectations can affect the educational and career choices of female students.

people, which is relevant to understanding gender disparities in STEM.

5. Active and participatory learning. Supports the idea that pedagogical strategies that foster active and collaborative participation can improve inclusion and achievement for all students. Freeman et al. (2014) demonstrate that active learning achievement in science, engineering, and mathematics.

DISCUSSION AND ANALYSIS OF RESULTS

First discussion. The results will be given in a conceptual theoretical analysis of the designs and instruments that will be used to carry out the field study, including the reference model to be used. It will include a design of mechanisms to capture both qualitative and quantitative information through a field study, conducting field activities, surveys, semi-structured interviews applied to focus groups.

Second discussion. The processing of the information, capture, codification and preliminary analysis will have a socialization of the results with the stakeholders, analysis of the implications of results, and proposals for intervention.

Third discussion. The development of this research highlights the importance of the field study will be conducted in the communities surrounding the city of Celaya through interviews, surveys, as well as the implementation of strategies have proven to be effective in various situations and educational contexts.

Table 1. STEM factorial data.

Program	Factor	Strategies	General appearance
Science	Learning and environment inclusive	Develop an Environment inclusive	Promote an environment and culture of gender education in areas and disciplines.
Technology	Experiences	Development and socialization	
Engineering	Participatory learning	Implementation of methods pedagogical	
Mathematics	Mentoring and networking	Introduction of seminars and programs	

CONCLUSIONS

First line of future research. The fundamental premise is that the city of Celaya, Gto. will be developed, the conceptual section and integration of reports will be carried out at the Instituto Tecnológico de Roque, Department of Economic and Administrative Sciences and the establishment of mentors and support networks can be fundamental for professional development, in the equal participation in scientific fields.

Second line of future research will be to implement a comprehensive approach that encompasses multiple strategies can significantly increase gender equitable participation in STEM programs in order to emphasize mentoring, structured support to facilitate the growth and success of new scientists.

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