Gender equality in STEM: actions of Habitat Marte

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Abstract

The present research analyzed the actions of the promotion of Gender Equality in science, technology, engineering and mathematics (STEM) promoted by the space analog simulation station Habitat Marte (Brazil), evaluating the strategies for the development of a greater equality of opportunities between genders in academic field.

Habitat Marte is the first Mars analog simulation station in the Southern hemisphere operating in rural area of Caiçara do Rio do Vento, Rio Grande do Norte State, Brazil.

The research was motivated by the challenge to present a larger participation of Women in the space analog mission. Was searched to evaluate what could be done to promote a greater inclusion of girls and young people in the STEM field, thus contributing to the promotion of the SDG 5 - Gender equality.

Among the imagined actions that can be developed in the context of the research station are: 1 - Promotion of the participation of girls and young people in missions at Habitat Marte and in lectures and courses, encouraging them to seek opportunities in science, technology, engineering and mathematics via scientific careers; and 2 - Equality in the treatment and distribution of tasks among participants, regardless of gender, in missions at Habitat Marte.

Was identified that virtual missions expand the women participation. 2017 and 2018 Habitat Marte had the participation of 1 women each year. 2019, 3. 2020, more 3. Then, with virtual missions participated more 37 women, totalizing 40 participants during 2020. It is interesting see the increasing of women participation.

Key Words:
STEM, Gender Equality, Space, Sustainable Development.

1. Introduction

The present research analyzed the actions of the promotion of Gender Equality in science, technology, engineering and mathematics (STEM) promoted by the space analog simulation station Habitat Marte (Brazil), evaluating the strategies for the development of a greater equality of opportunities between genders in academic field.

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According to The Global Gender Gap Report 2018 (World Economic Forum: 2018), Brazil is in position 95 in the global ranking of gender difference. In the assessment of the Brazilian position in terms of economic participation and opportunity, it is ranked 92nd. Habitat Marte can be an instrument of collaboration for the insertion of women in STEM.

Habitat Marte had received organized groups from public and private schools and researchers from universities. During 2018 was presented a paper during International Conference on Sustainable Development (ICSD) about how the Habitat Marte is commited with SDGs.

2. Habitat Marte

Habitat Marte is one of the most innovative projects in stimulating the development of skills in the aerospace area in Southern Hemisphere. We hope that from the simulation experience your participants will be interested in academic and professional careers related to the space area.

Space analog station Habitat Marte is interested to create a new generation of people interested in science and technology, seeing knowledge as a tool to collaborate for sustainable development. We believe that the experience at Habitat Mars is motivating for its participants to empower themselves and expand their vision, based on a spatial experience, which can change the world, collaborating for a more prosperous world.

Habitat Marte works in the state of Rio Grande do Norte, in the Brazilian semiarid region, where it rains a few days a year. The Habitat Marte station is located in the rural area of the city of Caiçara do Rio do Vento, 100 km from Natal, on BR 304. The space analog station can be seen in the next Figure.

Figure 1. Habitat Marte.
Credits: Habitat Marte (2020).

In the experience of Rio Grande do Norte we are interested in designing systems that collaborate to have a self-sustainable / circular system in which the energy itself is generated, the waste generated is recycled and the food itself is produced. Habitat Marte is committed to develop social technologies such as: greenhouses, solar oven, cisterns, aquaponics, water filters and greenhouses. The challenge is to develop technologies that are applied both to space and in arid and semi-arid regions, or other regions threatened by water scarcity and droughts.

From December 2017 to 2020, 47 missions were developed with more than 200 participants, totaling more than 3000 hours, or 170 days of missions. These activities have generated a large volume of data, which has allowed to provide a variety of studies and publications.

The last presential mission finished during March, 14th 2020. During presential missions in Habitat Marte, some activities developed activities are: 1 - Collection of soil and mineral samples; 2 - Astronomical observation; 3 - Evaluation and improvement of life support systems at Habitat Marte; 4 - Test, improvement and evaluation of space suits and the Autonomous Sustainable Cooling Module; 5 - Performance of Extra-vehicular Activities (EVA); 6 - operationalization of intravehicular activities (IVA), actions carried out inside the station; 7 evaluation of behavioral aspects of the mission members; 8 - Reporting; 9 - Mapping of operational processes; and 10 - development of articles communicating the results generated in the missions; 11 - maintenance of the greenhouse and the aquaponics system.

3. Methodology

In a practical approach, based in participant observation, the research with characters engaged in Habitat Marte analog station management, evaluated the current situation of women participation in space analog missions. The methodology consisted of the following steps:

1st) Quantitative evaluation of amount of missions and participants;
2nd) Evaluation of strategy proposals related to the Sustainable Development Goal - SDG 5: Gender Equality;
3rd) The action: broader divulgation of Habitat Marte and virtual missions;
4th) Evaluating the results from virtual missions actions.

4. Evaluating the number of missions / participants

The missions were evaluated from December 2017 to April 2020. From that assessment, 120 participants were observed, with the female presence being only 10 women in 6 different teams, out of a total of 37 missions and 120 participants, corresponding to 16% of missions and 8% of all participants (21). This result warned of the need to include more women in future missions to Habitat Marte.

In the next photo can be seen the participants of the mission 9 (February 2019) with professor Julio Rezende, Camila Oliveira and Paula Vivian da Silva.

Figure 2. Mission 9' Official photo
Credits: Julio Rezende.

During mission 9 was evaluated how have more girls in the missions of Habitat Marte. And was imagined how this discussion would be transformed in a paper to be presented in the International Conference on Sustainable Development (ICSD). Part of the results of this discussion is presented in the next topic.

5. Strategies to expand girls participation in missions in Habitat Mars and in the field of STEM:

Was developed a brainstorm on strategies for expanding female participation in Habitat Mars missions and in the field of STEM seeking to promote gender equality. Among the imagined actions that can be developed in the context of the research station are:
1 - Promotion of the participation of girls and young people in missions at Habitat Marte and in lectures and courses, encouraging them to seek opportunities in science, technology, engineering and mathematics via scientific careers; and
2 - Equality in the treatment and distribution of tasks among participants, regardless of gender, in missions at Habitat Marte.

Some possible actions have been proposed to expand female participation in missions in Habitat Marte and in the field of STEM promoting gender equality:
- Formation of an exclusive missions with women.
- Scheduling a presentation on Habitat Mars in social movements with female participation.
- Emphasize the importance of Women participation in the missions;
- Keep the effort of divulgation of the Habitat Marte activities.

All activities and efforts of Habitat Marte astronaut training program are related to encourage the women be more confident to take advantage to follow and identify opportunities related to Science Technology, Engineering and Math (STEM).

The best developed strategy organized by Habitat Marte were the virtual missions and broader disclosure of this initiative worldwide. More details of this action is presented in the next topic.

6. Action: the advent of virtual missions

Since the beginning of coronavirus detection and spreading, in the beginning of 2020, during last 5 months (March-August, 2020), to face no more presential missions space analog station Habitat Marte developed a new methodology and started the virtual and hybrid missions reaching more than 200 participants, 174 days and 3000 hours. Before that, all mission were presential/ *in situ* in the facilities of Habitat Marte

Some virtual meetings /CapCom are shared to a broader audience been broadcasted in internet. One great achievement was the participant of the astronaut Marcos Pontes in the mission 45th (July/2020). The open meetings had been organized as an activity of the Mars Society Brazil. In the next Figure can be seen the crew with astronaut Marcos Pontes, minister of science and technology of Brazil.

Figure 3. Astronaut Marcos Pontes
Credits: Habitat Marte (2020).

Since the beginning of virtual missions, during all weeks the coordination of Habitat Marte had received e-mails from different parts of the World interested in analog virtual and in-situ missions. Habitat Marte had participants from more than 20 countries. The values of inclusion and respect have inspired participants around the planet be committed with STEM. Some participants applied their research results to 23rd Annual International Mars Society Convention. The Youtube channel in 4 months presents more than 100 videos.

Based in exposed results, it is possible affirm that virtual mission was a very disturbing new strategy to encourage the participation of women in the space analog virtual missions.

The virtual missions expand the women participation: during 2017 and 2018 Habitat Marte had the participation of 1 women each year. 2019, 3. 2020, more 3. Then, with virtual missions participated more 37 women, totalizing 40 participants until August 2020. In the next Figure is possible see the participants of the mission 39, called Demeter, a reference to Greek Goddess.

Figure 4. Infographic of the mission 39.
Credits: Habitat Marte (2020).

The mission Demeter was the mission with more women as participants than men. The members of the mission 39 were Agnieszka Elwertowska (Poland), Julio Rezende (Brazil), Ahmed Abdi (Somalia), Ruvimbo Samanga (Zimbabwe) and Anne Agi (Nigeria). The mission presented the following invited researchers: Davi Souza (Brazil) and Eva Blaisdell (United States).

In the next Table it is interesting identify three young students that participated in the space analog virtual missions of Habitat Marte from different parts of India.

Table 1. The case of three girls from India

Ravva Saranya 	Nikita Divay 	Kommared Tejaswi 
Mechanical engineering student in VNRVJIET, Hyderabad, India. Participated in the missions 46 and 47 (August, 2020)	Bachelor Of Engineering in Computer Engineering in Sardar Patel Institute of Technology, Mumbai. Participated in in the mission 44 (July, 2020)	Undergraduate student in JNTUH Electronics and Communication/ graduation in 2020, Hyderabad, India Participated in the mission 43 (July, 2020)

Evaluating how Habitat Marte had encouraged girls from many regions, based in the testimonials of three Indian students descripted in the Table above, it is possible identify great satisfaction observed in the personal video reports shared in YouTube channel of Habitat Marte: www.Youtube.com/HabitatMarte.

The virtual missions permitted to reach researchers interested in the operation of space habitats from many different countries.

7. The distribution of tasks during missions in Habitat Marte

No distinctions were found in the distribution of tasks during missions at the research station Habitat Marte. It can be considered useful, reading the operational manual that makes clear the various activities to be developed in the context of Habitat Mars. This knowledge contributes to a better distribution of tasks. The best distribution of tasks can avoid different conflicts, not always related to gender.

The equal opportunities in roles distributed in virtual missions it is also a strong point related to women inclusion and empowerment to STEM. The women in virtual missions were chiefs of different facilities, presenting wonderful presentations about the operation of future space habitats in Mars.

Women were encouraged to submit abstracts to the 23rd Annual International Mars Society Convention (October 15th-18th, 2020). Were approved abstracts from 5 women and 4 men. This represent more confidence from Women than men. For most of them it was the first time that they had an academic work approved at a meeting.

8.Final considerations

Was perceived a great challenge to sensibilize Brazilian women students to space activities. Habitat Marte keeps interest to identify more activities to achieve this audience.

The results of this research can contribute to other initiatives that wish to include girls' participation in STEM, especially in the aerospace area.

In practical terms, Habitat Marte should encourage the participation of girls in the development of research and social technologies (eg: water filters, vegetable gardens, hydroponics, biodigesters and greenhouses) with the potential for publication in specialized events and for scientific dissemination, as well as like specialized magazines.

It is pertinent to replicate the research methodology applied in the evaluation of the Habitat Marte missions with other stations analogous to Mars, in particular the Mars Desert Research Station - MDRS (Utah). From then on, a global survey could be carried out in order to identify stations with the best indicators regarding gender equality.

It is interesting see the increasing of the amount of women participation. In the future will developed calls specific to women.

Initiatives of space education developed by Habitat Marte are very strategic to encourage girls be committed with scientific careers and empowered to study more and develop new skills and find good opportunities in the market.

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