

## **Habitat Marte as a tool to promote the SDG in higher education**

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### **Abstract**

In Brazil is operating a very innovative experience related to promote Higher Education connected with Sustainable Development Goals: Habitat Marte, a Mars, Arid and sustainability research station based in Brazil ([www.HabitatMarte.com](http://www.HabitatMarte.com)).

In Habitat Marte happens research missions connecting possible technologies that would be applied to arid and semiarid regions, but also to Mars and Moon space habitats.

Habitat Marte had received organized groups from public and private schools and researchers from universities. In April 2019, was applied a survey to evaluate how the visitors evaluates how the initiative can be perceived as a place of Sustainable Development Goals practices applied to children and youth.

This study aims to measure the impact of Habitat Marte actions in the development of empowerment for the 17 SDGs.

Was applied a questionnaire containing 12 questions to a group of 24 students from local public school, in the age group from 14 to 18 years old.

As result was possible identify based on the survey: 65% are women and 35% are men, a good indicator of participation of women in education activities, but also a worry about why boys are not participating in school activities. Some results related to Sustainable Development Goals were: 1 - All visitors realized that Habitat Mars is a space that contributes to quality education (Goal 4); 2 - 96% realized that girls should be stimulated to scientific careers (Goal 5 – Gender equality); 3 - 91% considered Habitat Marte activities as very innovative (Goal 9); 4 - 83% were interested to participate in a mission of Habitat Marte; 5 - 87% were interested in the aerospace area when visiting the Habitat Marte; 6 - 91% considered Habitat Marte partnerships with the school are positive (Goal 17).

Was possible observe that Habitat Marte is contributing to spark the interest of youth to Science, Technology, Engineering, Arts and Math (STEAM) careers and build more strong ties integrating the academia community to Sustainable Development Goals. Frequently the SDGs had been presented in all lectures done by Habitat Marte representatives. The practices of SDG operated by Habitat Marte are contributing each day to higher popularization of 17 Goals inside the academia.

Was possible identify that Habitat Marte is promoting knowledge, skills, and motivation to address the SDGs. The initiative had done lectures in schools, universities and events stimulating the audience be committed with a Quality Education (SDG 4) and scientific careers. University students former participants of Mars analog research missions also present a higher commitment to develop a researcher career through masters and doctoral programs.

The Sustainable Development Goals can be a strategic tool to students from fundamental, high schools and bachelors perceive how their process of learning and scientific career development would be connected with a meaning of life and a higher purpose of responsible action in the planet.

### **Key-words:**

STEAM, STEM, Space Education, SDG, Habitat Marte.

## 1. Introduction

In Brazil is operating a very innovative experience related to promote Higher Education connected with Sustainable Development Goals: Habitat Marte, a Mars, Arid and sustainability research station based in Brazil ([www.HabitatMarte.com](http://www.HabitatMarte.com)).

In Habitat Marte happens research missions connecting possible technologies that would be applied to arid and semiarid regions, but also to Mars and Moon space habitats.

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 committed with SDGs.

In April 2019, was applied a survey to evaluate how the visitors perceives Habitat Marte as a place of Sustainable Development Goals practices applied to children and youth. The Habitat Marte coordinators considers that the some children and youth touched by the spark of space science would be interested for space science.

It is also an aim of the research identify how Habitat Marte is impacting the application of SDG in higher education. This aspect is more related to the members of the missions of Habitat Marte.

## 2. About Habitat Marte

How the operation of Mars analog research station, operating in our planet, can be an opportunity to reflect about the application of Sustainable Development Goals (SDGs)? This is a question that guides Habitat Marte.

Habitat Marte is located in Nucleus of Research in Engineering, Science and Sustainability of Semiarid (NUPECS), rural area of the city Caiçara do Rio do Vento in Rio Grande do Norte State, Northeast Region, Brazil, 100 km from the capital Natal.

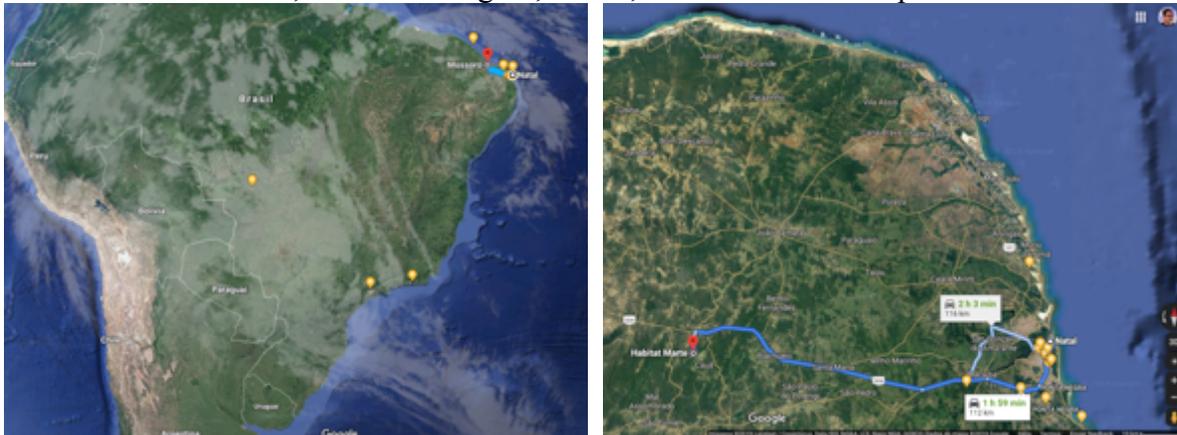


Figure 1. Location of Habitat Marte

Source: Google Maps.

As can be seen in the maps above, Habitat Marte is located in Rio Grande do Norte State, in the corner of South America, the eastern area in America.

In the site there is infrastructure support as an auditorium, cafeteria and accommodations. The initiative is a project that aims to be a space for the development of sustainability research aimed at living with climate change in semi-arid Northeast. The Nucleus of Research in Engineering, Science and Sustainability of Semiarid (NUPECS) is located in an area living the worst drought of the last century. More information about the NUPECS can be obtained at: <http://www.NUPECSufrn.blogspot.com> (REZENDE: 2017). In the next Figure can be seen one of the initiatives developed in NUPECS.



Figure 2. House using glass bottles  
Source: Rezende (2017).

Previous image registers one physical space done with glass bottle. The Nucleus of Research in Engineering, Science and Sustainability of Semiarid (NUPECS) and the Habitat Marte are located in the semiarid of Brazil, region affected by 8 years severe droughts (2011-2018) related to climate change effects. The Habitat Marte can be an unique opportunity to evaluates how the development of self-sustainable habitats concepts can be applied in arid and semiarid environments (REZENDE: 2018).

The Mars analog research station Habitat Marte was created to develop activities of education and research related to Science, Space, Sustainability, Technology, Engineering, Math (S3TEM). Because of the water scarcity, the Brazilian Mars research station operates one confined mission by month when happens Intravehicular Activities (IVA) and Extravehicular Activities (EVA), occurring different kinds of research and operations. Habitat Marte born as a project from the Industrial Engineering Department of Universidade Federal do Rio Grande do Norte (UFRN) accepting graduate and post-graduate students from Electrical and Mechanical Engineering, Agronomy, Biotechnology, Physics and Geology and other courses.

In the next photo can be seen a photo of first mission developed in Habitat Marte and organized for the first time in a Mars research station in Brazil.



Figure 3. First Mission in Habitat Marte  
Source: Rezende (2017).

The first Mars simulation mission in Brazil, at the Habitat Mars research station, was held from December 8th to 10th, 2017. The first team to conduct the Mars analog research mission at Habitat Marte was composed of three undergraduates and a UFRN professor. Until July 2019 happened 19 mission with different goals.

Since the first mission were developed different activities such as: 1 - Collection of soil sample and minerals; 2 - Astronomical observation; 3 - Evaluation and improvement of life support systems in Habitat Marte; 4 - Test, improvement and evaluation of spacesuits and the Autonomous Module of Sustainable Cooling; 5 - operation of intravehicular activities (IVA); 6 - Behavioral tests; 7 - Reports preparation; 8 – evaluation about how to achieve the Sustainable Development Goals (SDGs); 9 – Construction of new facilities; 10 -Preparation and operation of Food production system, based in aquaponics.

### **3. Promoting the SDG in higher education**

How the Sustainable Development Goals (SDG) would be spread in the university, connecting students and professors to solve real social, environmental and economic problems? It is a great challenge creates more awareness in university about SDG. In Brazil, some research had explored and encouraged the use of SDG to a broader perception about how SDG would be used as a tool of research. Would possible mention the studies of Rezende (2018) about how to apply SDG to Mars research station Habitat Marte. The research about Rio Grande do Norte state foundation (Brazil) is also encouraging the SDG (Rezende, Lima: 2018), as the research done by Rezende, Araújo, Bezerra, Pereira, Pessoa, Gouvinhas and Vilela (2018), discuss how SDG would be in operation in universities.

According United Nations (2017), those are the Sustainable Development Goals to be achieved:

Goal 1. End poverty in all its forms everywhere;

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture;

Goal 3. Ensure healthy lives and promote well-being for all at all ages;

Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all;

Goal 5. Achieve gender equality and empower all women and girls;

Goal 6. Ensure availability and sustainable management of water and sanitation for all;

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all;

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all;

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation;

Goal 10. Reduce inequality within and among countries;

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable;

Goal 12. Ensure sustainable consumption and production patterns;

Goal 13. Take urgent action to combat climate change and its impacts;

Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development;

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss;

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels;

Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development.

#### **4. Methodology**

This study aims to measure the impact of Habitat Marte actions in the development of empowerment for the 17 SDGs.

Was applied a questionnaire containing 12 questions to a group of 24 students from local public school, in the age group from 14 to 18 years old.

The questions were related to:

- 1 – Age;
- 2 – Gender;
- 3 - Perception about Habitat Marte be a space that contributes to quality education (Goal 4);
- 4 - Girls should be stimulated to scientific careers (Goal 5 – Gender equality);
- 5 – Perception about Habitat Marte activities as very innovative (Goal 9)
- 6 – Creation of interest to participate in a mission of Habitat Marte;
- 7 - Creation of interest in the aerospace area when visiting the Habitat Marte;
- 8 – Partnerships of Habitat Marte and school (Goal 17).

The Sustainable Development Goals (SDG) operated in geographic organizational local ecosystems had been studied in Brazil by Rezende (2017) in case studies. His studies were considered in the theoretical review and observation of topics in the present research.

#### **5. Results**

##### **5.1 – Age and gender**

As result was possible identify based on the survey: 65% are women and 35% are men, a good indicator of participation of women in education activities, but also a worry about why boys are not participating in school activities.

About the age, Habitat Marte and NUPECS receive a broad range of visitors. Since students from elemental school, middle school and university students.

##### **5.2 - Perception about Habitat Marte be a space that contributes to quality education (Goal 4)**

The main result of Habitat Marte can be seen as to apply Sustainable Development Goals to local community of Caiçara do Rio do Vento. All visitors interviewed say it that Habitat Marte is an initiative that contributes to quality education (Goal 4).

Also observing the members of the Mars analog missions, it is also possible perceive challenges about to develop new scientific skills related to topics such as food production system, engineering requirements, spacesuits, life support systems, and other aspects. Based on this, is possible affirm that Habitat Marte contributes to quality education and for development of scientific careers.

##### **5.3 - Girls should be stimulated to scientific careers (Goal 5 – Gender equality)**

One challenge of Habitat Marte is identify strategies to bring girls and women to be part of the crews of Mars analog research missions. In all lectures and visits to Habitat Marte the discourse is about the girls be committed with scientific careers.

Questioned, 96% of the audience confirmed about the stimulus of Habitat Marte to be committed to scientific careers (Goal 5 – Gender equality). The next picture registers the first mission in Habitat Marte with two girls.



Figure 4. Girls in a Mission in Habitat Marte  
Source: Julio Rezende.

The mission reported in the photo was the first during 2019 and was focused about reflect about how have more girls in Mars analog research missions in Habitat Marte.

#### **5.4 – Perception about Habitat Marte activities as very innovative (Goal 9)**

91% considered Habitat Marte activities as very innovative (Goal 9). Part of the innovation of Habitat Marte is to develop solutions that would be applied to space habitats. Considering this topic of research it is correct to affirm that Habitat Marte is the only initiative in Brazil to develop this kind of skill. In the next picture can be seen the operation of the SPACE AQUA – Smart Aquaponic For Space, Arid and Circular System



Figure 5. SPACE AQUA – Smart Aquaponic For Space, Arid and Circular System  
Source: Julio Rezende.

It is possible affirm that SPACE AQUA – Smart Aquaponic For Space, Arid and Circular System consider the use of automation, coding in food production, to be applied in Space Habitats and areas affected by climate change considering the aspects: Temperature, Humidity, Pluviometric levels and Fish Ration activation.

#### **5.5 – Creation of interest to participate in a mission of Habitat Marte**

Based in the interview, 83% were interested to participate in a mission of Habitat Marte. None all said be interested in to be part of missions.

## 5.6 - Creation of interest in the aerospace area when visiting the Habitat Marte

87% were interested in the aerospace area when had visited the Habitat Marte. The next figure registers the moment of students visiting Habitat Marte.



Figure 6. Students visiting Habitat Marte

Source: Julio Rezende.

## 5.7 – Partnerships of Habitat Marte and school (Goal 17)

91% considered Habitat Marte partnerships with the school are very positive (Goal 17). The coordinators of the school and Habitat Marte are in constant interaction to identify new days to happen new technical visits to Habitat Marte and NUPECS.

## 6. Conclusion

Was possible observe that Habitat Marte is contributing to spark the interest of youth to Science, Technology, Engineering, Arts and Math (STEAM) careers and build more strong ties integrating the academia community to Sustainable Development Goals. Frequently the SDGs had been presented in all lectures done by Habitat Marte representatives. The practices of SDG operated by Habitat Marte are contributing each day to higher popularization of 17 Goals inside the academia.

Was possible identify that Habitat Marte is promoting knowledge, skills, and motivation to address the SDGs. The initiative had done lectures in schools, universities and events stimulating the audience be committed with a Quality Education (SDG 4) and scientific careers. University students former participants of Mars analog research missions also present a higher commitment to develop a researcher career through masters and doctoral programs.

The Sustainable Development Goals can be a strategic tool to students from fundamental, high schools and bachelors perceive how their process of learning and scientific career development would be connected with a meaning of life and a higher purpose of responsible action in the planet.

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