Ground Station in the classroom

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Summary

After the Nuestra Madre de la Alborada School, was registered, in July 2014, in the system HERMES of the Ecuadorian Civilian Space Agency, EXA, and the recording and decoding in real time of the images of the climate satellites of the NOAA was done, the idea came for the project "Ground Station in the classroom" which is an initiative that is born in October 2014 in a video conference with the first Ecuadorian Astronaut Commander Ronnie Nader Bello and the Astronautic Club of the Nuestra Madre de la Alborada School in Guayaquil, Ecuador. The main idea of the project was that the students themselves built and set up the Quadrifilar Helix (QFH) antenna, to capture the images through a decoding device donated by the Ecuadorian Civilian Space Agency, EXA.

In this paper we will recount the experiences of the students, their opinion of the inclusion of initiatives like this, the impact this had on their self-esteem and their new vision of science.

Introduction

In the Nuestra Madre de la Alborada School, located in Guayaquil, Ecuador, inspired by the launching of the two Ecuadorian Satellites, NEE-01 PEGASO and NEE-02 KRYSAOR, by the first Ecuadorian Astronaut Commander Ronnie Nader Bello, the idea arises of beginning an educational process in the area of Astronautics in the institution. This is why the decision is made of visiting the Planetarium and an exposition to the students explaining what the satellites are, what uses they have, that Ecuador has a Space Agency, and the achievements that the Ecuadorian Space Agency, EXA, has had in this field, so that they are aware of the potential that there is in this field of the science and the possibility that they, the students, become part of this activity. The result was the beginning of the Astronautics Club of the Nuestra

Madre de la Alborada School, which began in July 2014, with the purpose of imbuing them with the interest of the astronautical sciences and to let them know the basic concepts, giving this way the opportunity for the students to be able to have and develop the wish to get involved in the space exploration.

In the Astronautics Club, we have students from the second year of basic education up to the tenth year, with a fluctuation of ages ranging from 6 years to 14 years and a total population of 22 students.

Initially we proceeded to investigate and analyze the achievements made by the Ecuadorian Space Agency in the space program, its missions and projects, the enthusiasm of students grew as they investigated more about these achievements and projects, giving them the opportunity to know that these space developments can be undertaken in Ecuador.

Students from the Astronautics Club during a video conference with the First Ecuadorian Astronaut Cmdr. Ronnie Nader Bello

Thanks to the support obtained by the Ecuadorian Space Agency and the directors of the institution, we have been able to incorporate the equipment for academic teaching in the field of space science. This equipment and laboratories include astronomical laboratories, a flight simulator in virtual reality, a small fleet of drones, robotics labs and we have even begun to develop books of Astronautics, and proceeded to the incorporation of Astronautics and Robotics as official subjects of the curriculum of the institution. This is why, currently, the total population of pupils involved in the study and development of these areas and projects corresponds to all the students, that is to say, from Preschool, Basic Education, and General High School of the institution.

Astronomical Lab: It currently has a robotic telescope, filters for observing the Sun and different planets, and it has 2 mini planetariums for the study of constellations and celestial bodies.

Virtual reality flight simulator: This Simulator is oriented to the youngest students, from 3 years old. It is equipped with glasses and virtual reality chair, connected to a computer which, by means of a simulation software, allows students to fly drones and other aircrafts, enabling them since a very early age to develop better motor skills and coordination, and enhance the speed of thought and decision making in critical and unexpected situations.

Mini fleet of Drones:

After receiving the donation of a Drone by the Ecuadorian Space Agency, we proceeded to acquire two additional drones and put together a small fleet of drones, which are made available to students from the kindergarten, to strengthen and develop coordination, mobility, notions about movement in space, allowing strengthening and increasing the thinking processes from the earliest ages.

Robotics Laboratory: Complementing the interests for astronautics, we proceeded to acquire a robotics laboratory, specialized for K-10 children (Kindergarten and Basic Education) and more complex ones for high school students, allowing for different projects such as measuring air temperature, humidity, UV radiation, automating environments, creating mobile robots, etc.

Development of Educational Texts in the Astronautics area.

Because of the need to reach the youngest students with initial knowledge in the world of astronautics and space sciences, and the nonexistence of material with these conditions, we were forced to start developing educational texts, taking into account age, mental capacity and understanding of students of different levels. This is why the publication was done of the "Compendio de Astronáutica" for levels 1 and 2 by Prof. Roberto Falconí Vásquez.

Applications and Tools

Through applications like Google Earth added with satellite tracking tools such as KMZ format and online sites such as http://www.satflare.com/, free applications like Orbitron and WxToImg we could follow, monitor, view and download images in real time from the NOAA satellites, this latter process could be carried out through the HERMES system of EXA

Preparation

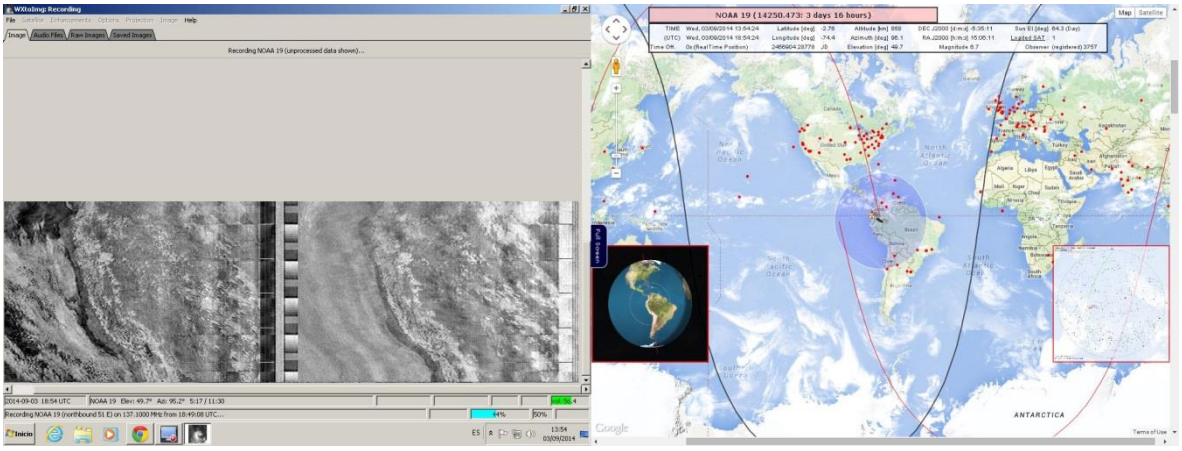
The Teacher preparation began by researching about the Ecuadorian Space Agency, its achievements and projects considered in the space program, about Ecuadorian Satellites and those from other countries in the region, as well as about projects and achievements in other educational establishments.

With self preparation and recommendations submitted by Professor Margot Solverg, we were able to locate the necessary applications for this process.

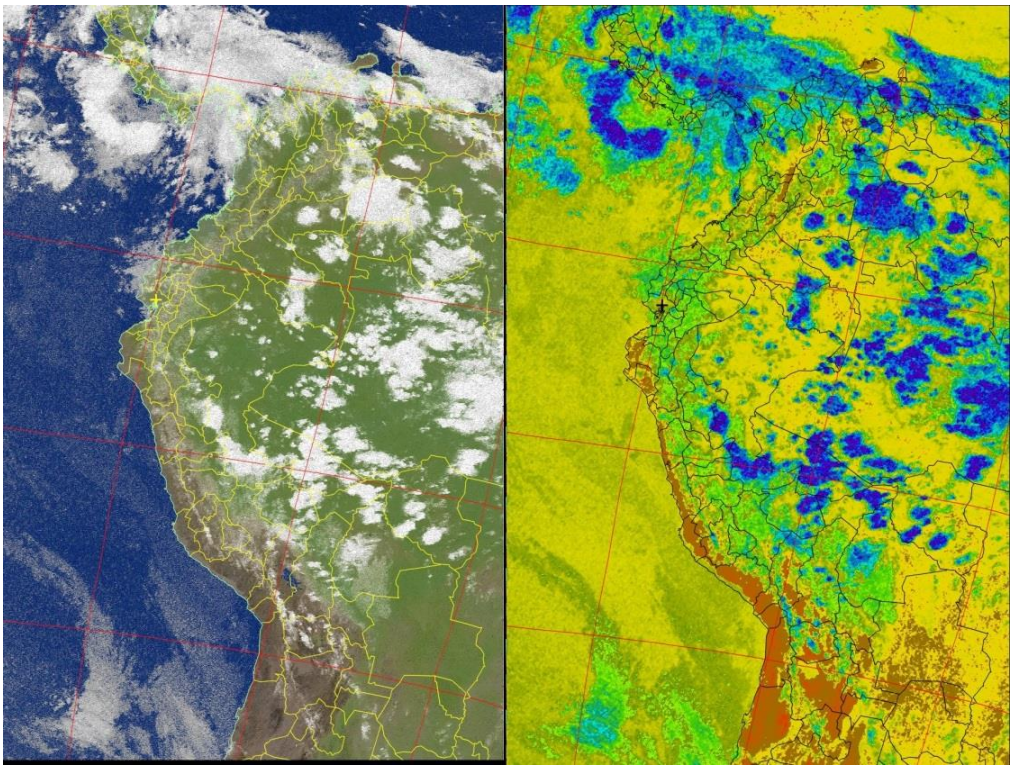
After learning to use them, by using information available online, we could install and configure the applications of Orbitron, WxToImg and VRS Remote Monitor.

As a practice, from YouTube we used the audio of other people's videos that captured signals from NOAA satellites.

Once requesting the membership and registering in the Hermes system, by using the Remote Monitor VRS application, we could connect via the Internet using this technology bridge and capture images of the earth from space.



First images captured in the institution with the Hermes system



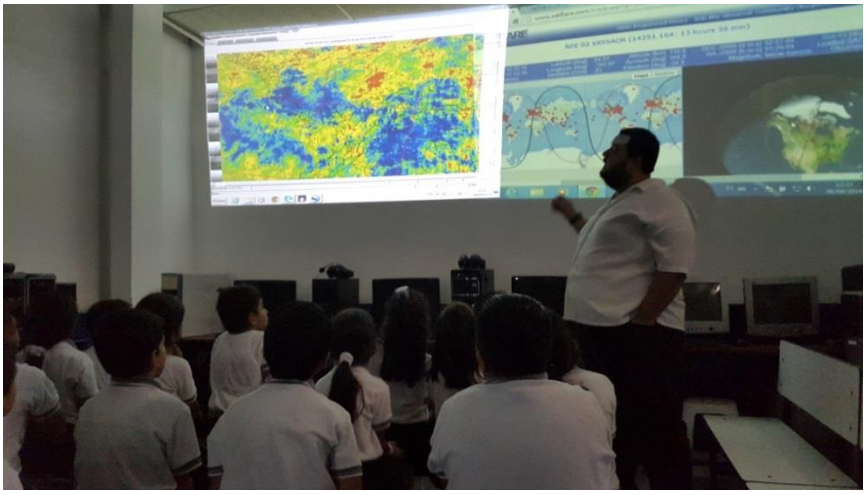
Color and Thermal image of Ecuador and South America captured by the WxToImg application with the HERMES system of EXA

Methodology

With the exhibition of the achievements made by the Ecuadorian Space Agency regarding the construction of technological bridge HERMES, the building and setting up in the space of the Ecuadorian Satellites Pegasus and Krysaor, among other achievements, we could arouse the interest and enthusiasm of students, allowing us to start the Astronautics Club Nuestra Madre de la Alborada.

From this, visits were made to the Planetarium of the City where they could learn about the universe, constellations, the solar system and other topics.

Likewise, talks and lectures were done about the importance and operation of satellites, their applications and benefits, focusing mostly on the Meteorological Satellites of the NOAA.



Lecture about the importance of Meteorological Satellites

The Challenge

During a video conference with Cmdr. Ronnie Nader Bello, the idea came up of taking things to the next level, involving students more actively, enabling them to move from spectators to protagonists, and allowing them to realize that they can also do something, and that regardless of age, with effort, dedication and proper guidance they could build and create something very important. This is why the Ecuadorian Space Agency, proposed us to build an antenna to catch the signal from the weather satellites from NOAA. They would provide us the corresponding decoder.

After researching about the type of antenna required, we found that we had to build a QFH (quad helix), Helical Quadrifilar antenna at a frequency of 137 MHz, so we proceeded to

search for information, finding some plans and designs that allowed us to build it very satisfactorily.

Students of the Astronautics Club making measurements for building QFH antenna for receiving satellite signals

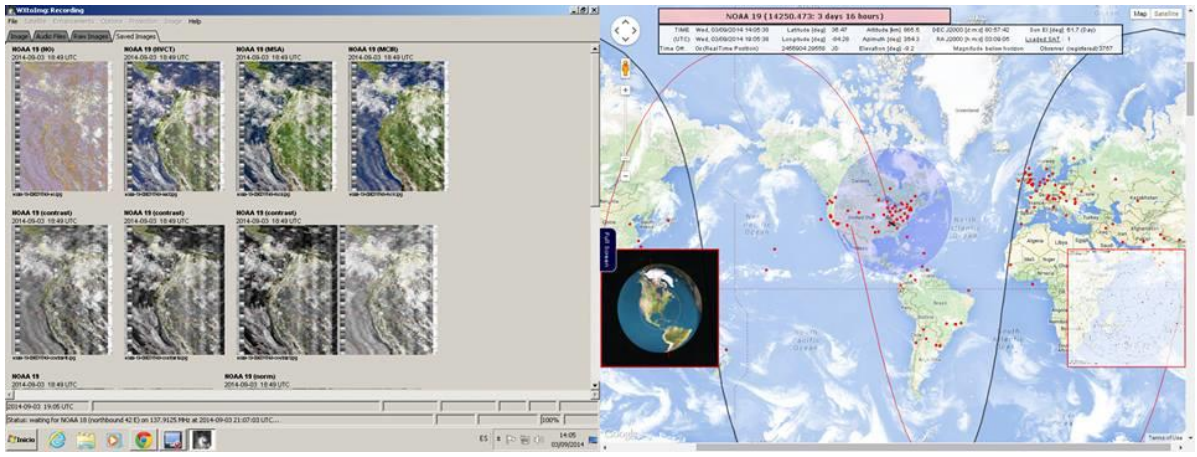
During the process of manufacturing of the antenna, the students had the opportunity to develop their qualities of teamwork, leadership, tolerance, and were able to perform the task very satisfactorily, identifying the particular qualities and setting up specialized working teams in each task. Then they proceeded to make the assembly and finished the Antenna.

Teacher and students of the Astronautics Club show the finished antennas.

Motivation

After the construction of the antenna QFH, EXA delivered the receiver of the satellite images WeSaCom APT-06 which caused enthusiasm among the students of the club and of the institution, allowing to carry out the first tests of the antenna built by the students. When they saw how the outcome of their effort and hard work functioned, and that they could hear the satellite signals, and see line-by-line the images being decoded by the equipment, they slowly realized that they could also build great things and that with will and dedication they could make their dreams and longings come true.

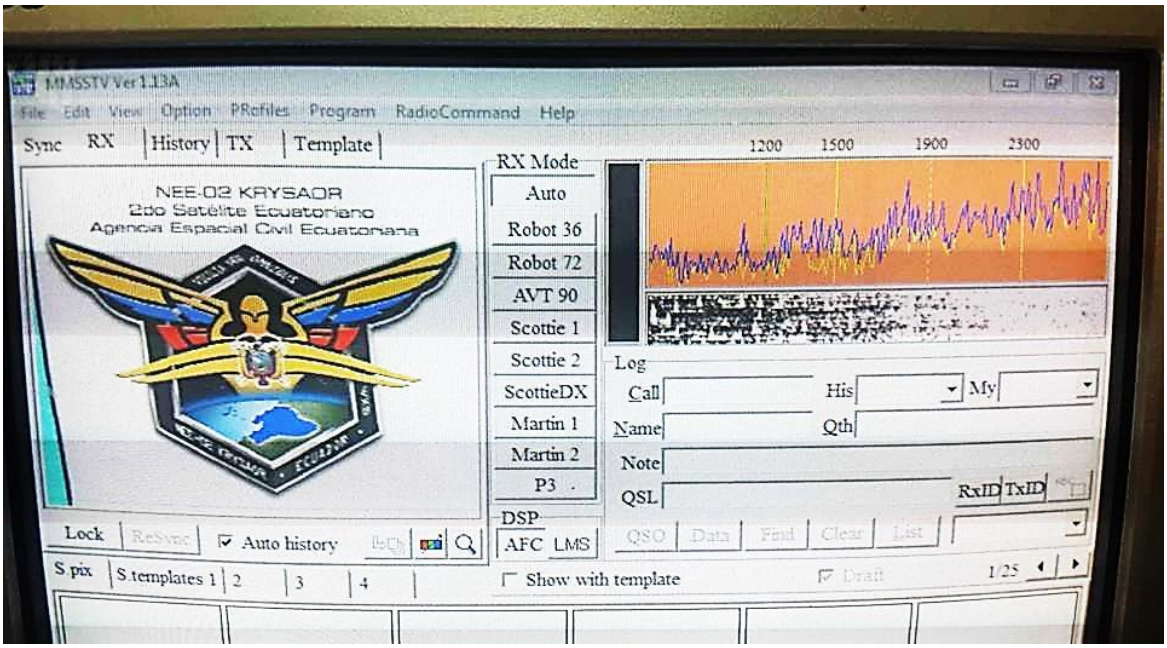
Student testing and holding Antenna during the passing of the NOAA 19 Satellite before its final location



First images received by the antenna built by the students of the Club.

Antenna installed in its final location.

Decoding signals of Krysaor: With the help of decoding software, SSTV (MMSSTV), and Morse code interpreters, we could perform the encoding of signals sent by the Ecuadorian Satellite NEE-02 KRYSAOR, allowing us to download an image transmitted by SSTV



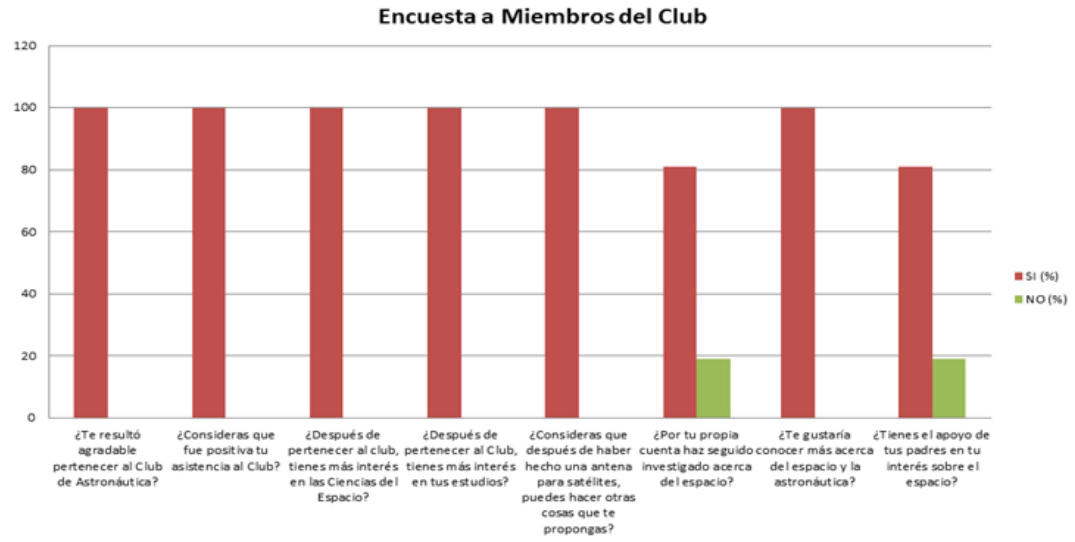
Ground Station for Space Monitoring

With all these developments in the institution, we proceeded to consolidate them in the Ground Station for Space Monitoring which remains on, 24/7, receiving weather signals from satellites NOAA-15, NOAA-18 and NOAA-19, and posting them to the whole world via the Internet through its website HTTP://ASTRO.UENMA.EDU.EC

II Results

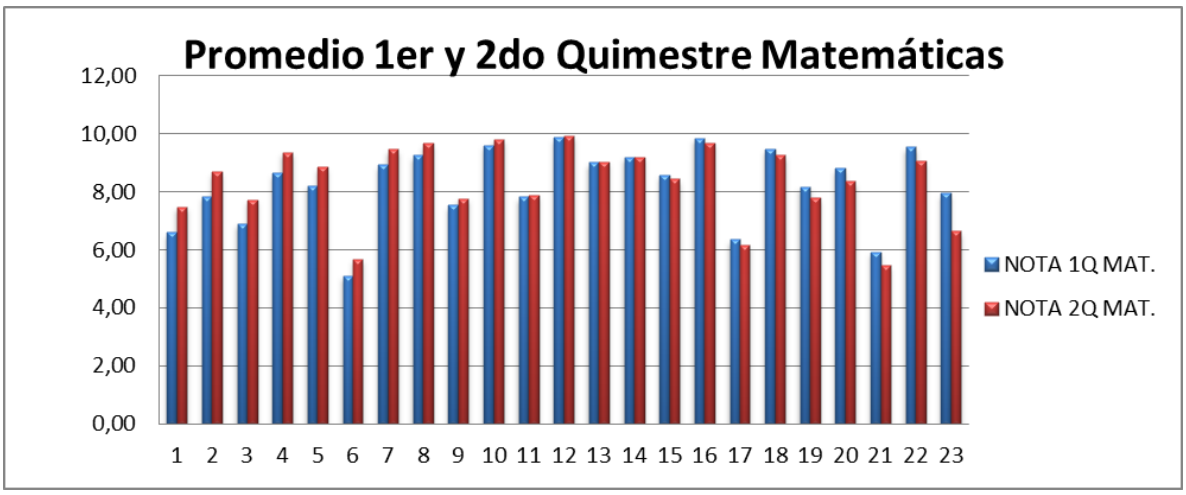
After the holiday period, we surveyed students from the Astronautic Club, with the following results:

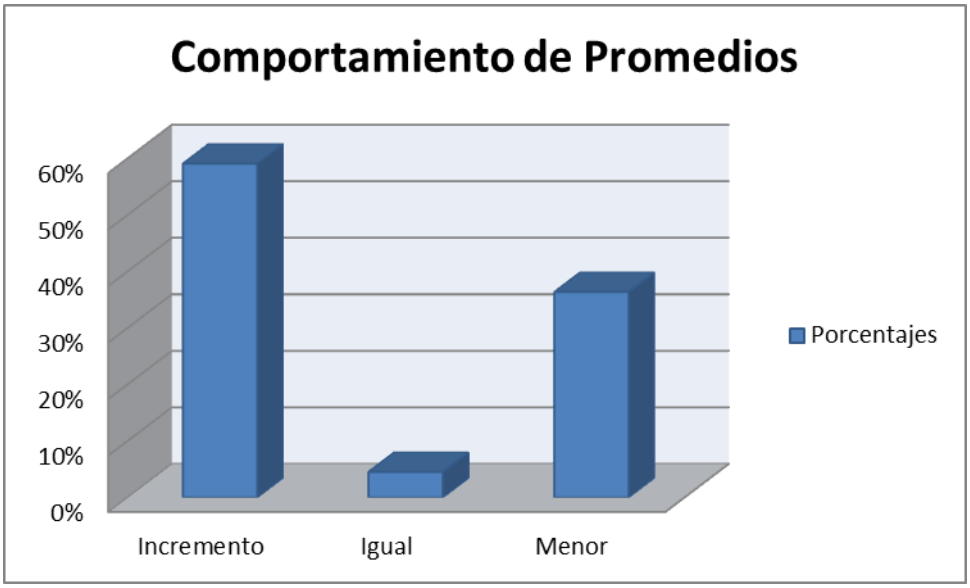
Questions	YES (%)	NO (%)
Did you like to be part of the Astronautics Club?	100	0
Do you consider positive your attendance to the Club?	100	0
After being a member of the Club, are you more interested in Space Sciences?	100	0
After being a member of the Club, are you more interested in your studies?	100	0
Do you think that after having done an antenna for satellites, you could do other things if you set your mind to it?	100	0
Have you continued investigating about space on your own?	81	19
Would you like to know more about the space and Astronautics?	100	0
Do you have support from your parents regarding your interest about space?	81	19



List of students of the First Astronautics Club with their grades by five-month period before and after the Club

Students	Grades 1Q MAT.	Grades 2Q MAT.
1	6,59	7,47
2	7,85	8,69
3	6,90	7,72
4	8,65	9,37
5	8,22	8,85
6	5,10	5,67
7	8,94	9,47
8	9,25	9,67
9	7,53	7,77
10	9,61	9,80
11	7,82	7,89
12	9,88	9,94
13	9,01	9,03
14	9,20	9,20
15	8,59	8,43
16	9,86	9,68
17	6,35	6,17
18	9,48	9,26
19	8,18	7,78
20	8,80	8,36
21	5,92	5,45
22	9,54	9,05
23	7,94	6,64





We can observe an increase in the academic average in Mathematics, it was also observed a higher degree of confidence in their ability to learn and solve problems.

Looking at the results of surveys of club members and contrasting them with the increasing averages in the area of mathematics between one period and another, let us remember that the Astronautics Club began after the first five-month period. We can understand that by motivating students with scientific activities where they are allowed to materialize projects, they strengthen their academic skills and improve their predisposition towards research, resulting in a higher school performance.

Breaking barriers

After the construction and installation of the receiving antenna of signals from satellites of NOAA, both, the students who were in the Astronautics Club as well as those who were not, realized that they can do anything with dedication and effort, which served to break down barriers and mental paradigms that make them think that only other countries can build such things or have access to this technology.

Increase of Self-Esteem

All the students involved in the construction of the antenna, after this experience and seeing it working believed they can achieve the goals and objectives that are proposed with effort and dedication, which has raised the level of self-esteem and self-love among each one of them.

Self Research

A great motivator for the teacher is to see that he has planted in fertile ground, seeing that students have continued to research on their own, and that the Astronautics Club served to awaken in them the scientific curiosity about the topics of Space Science.

Conclusions

We can observe without a doubt, that in the field of space science, it is possible that the student comes from spectator to the protagonist. It is an inertial motor that stays on along the time, where it is achieved that the students increase awareness of their skills, appreciate and value them, that they keep researching on their own, increasing their self-esteem, and increasingly appreciating and considering the sciences.

Acknowledgement

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