Final report of workshop:

"Climate change and environmental monitoring"

created by:

Centro de Energía Renovable y Calidad Ambiental A.C. (CERCA)

with the support of:

Future Without Poverty (FWOP)

Baja California Sur, Mexico, February 15TH of 2021

INDEX

1. General information

Due to the efforts made to use air quality monitoring systems with low-cost devices by the Centro de Energía Renovable y Calidad Ambiental A.C. (CERCA) and Future Without Poverty (FWOP), the idea was raised to distribute devices and train users to have a broad context about air quality and know how the devices work. This will create a wide network of monitors, information and collaborators interested in improving the current environmental quality. In this report, the methodology used to teach a workshop with 10 hours of content is described, as well as conclusions and analysis of the results obtained. A step prior to giving the workshop was the creation of the content and planning of the times, for this, information technologies and updated bibliographic sources were used, in addition a pilot workshop was carried out with CERCA institutional personnel, providing improvements and reliability. The content and sessions of the workshop were conducted in Spanish, likewise 100% of the participants were from educational institutions in Mexico.

2. Methodology

1. Generation of workshop content: Consultation of information with reliable and updated sources (divided into two blocks: theoretical and practical).
2. Design and use of ICT tools for virtual activities.
3. Logistics work with FWOP (Future Without Poverty) and participants for the implementation of the workshop.
4. Review of devices to configure and adaptation of course content.
5. Presentation of the workshop on a pilot basis to the CERCA internal team.
6. Review and update of the material with the necessary corrections observed in the pilot process.
7. Sending invitations to participants and assigning permissions in Jamboard and digital tools.
8. Delivery of courses two-hour daily sessions.
9. Daily evaluations of acquired knowledge and satisfaction.
10. Transition on day 3 of practical block.
11. Sending certificates of participation and configuration manuals at the end of the course.

2.1 Course content

The topics addressed in this course were divided into 5 days with the objectives set out in table 1. Most of the blocks were by days, except for day 3 where two blocks were presented.

Bloque	Objetivos	División	Duración
Day 1	Learn basic concepts of pollution, differences between air pollution and air quality.	Theoretical	2 hrs
Day 2	Know and differentiate concepts of climate change, its consequences and actions to mitigate it.	Theoretical	2 hrs
Day 3	Appropriation of air quality concepts and how to mitigate with our individual actions.	Theoretical	2 hrs
Day 3	Know the types of sensors, data and devices used for environmental monitoring and identify how to make a home particle detector.	Practical	2 hrs
Day 4	Know the necessary instrumentation for the measurement of air quality from the exploration of sensors and low-cost electronic components.	Practical	2 hrs
Day 5	Get to know web platforms to monitor air quality to understand how the DIY device will contribute to a monitoring network. Configure your own device.	Practical	2 hrs

Table 2.1.- Content of the course

3. Attendee participation

In total, the workshop was made up of 7 participants from different schools located in CDMX and Guadalajara, a greater commitment and level of participation was observed by the women who participated in the workshop, whereas the men who interacted had a less decisive and constant participation. In the following table we can recognize the participants, the institution to which they belong and the level of participation observed by the speakers of each person.

We had an attendance of teachers from 3 different institutions COVAEM in the State of Mexico, Subire in Guadalajara, Unión Mexico de Ciudad de México and Dayani representing FWOP (Future Without Poverty):

	Participant name	**Institution to which they belong**	**Participation level**
1	San Juana Arellano Martinez	COVAEM del EdoMex	High
2	Fernanda Méndez Ornelas	Subire	High
3	Mariela Razo Carrillo	Subire	High
4	Yolanda Martinez Alvarado	Union México	High
5	Edwin Francisco	Union México	Medium
6	Juan Diego Cervantes Perez	Union México	Medium
7	Dayani Davilla	Universidad del Norte de Texas (FWOP)	Medium

Table 3.1. Participants and level of participation

4. Evidence of activities and assimilation of knowledge

In this section the evidence of didactic resources used in the different blocks of the workshop are exposed with which the assimilation of knowledge of the participants and the dynamics worked can be found. For part of block 1 and 2, a multiple-choice online questionnaire was implemented where an assimilation of knowledge of an average of 65% can be observed, in which there were questions with very precise chemical terms that could impact on the assertiveness of the answer. But in general, an understanding of what is shared and assimilation of more than 50% of the knowledge can be reflected. In image 4.1 you can see what were the results of the questions implemented:

Questions	# Correct	# Incorrect
La principal fuente de emisión que genera este contaminante es la industria.	1	6
Que contaminante criterio es producto de la mala combustión y las fuentes móviles son los principales contribuyentes de emisión.	5	2
Este contaminante se puede aumentar rápidamente cuando existe una concentración elevada de 4 componentes; compuestos orgánicos volátiles,	6	1
El Material Particulado se clasifica en dos tamaños de micras _____ y _____.	4	3
Los PM y el Plomo son contaminantes criterio sólidos a diferencia de los demás que son gases.	4	3
¿Cuál es la diferencia entre efecto invernadero y calentamiento global?	3	4
¿Qué es el cambio climático?	7	0
Selecciona los 3 ejemplos de gases de efecto invernadero	3	4
Selecciona los 3 ejemplos de contaminantes criterio:	1	6
Seleccione las opciones que son consecuencias del efecto invernadero intensificado:	4	3
Total	38	32

Image 4.1.Questions of the first and second block.

At the end of block two, a dynamic activity was carried out in teams in which each team had to choose a Sustainable Development Goal, previously exposed, to put together a project that could be implemented in their classrooms. In Annex 2 two examples of the proposed projects that were interesting proposals are presented, for example for SDG 13 ¨Adopt urgent measures to combat climate change and its effects¨ the teachers proposed a massive networking campaign carried out by the students to the community, with the aim of raising awareness about the impact of climate change and generating individual pollutant reduction. Another very interesting project that was proposed was based on SDG 15 on ¨Life and terrestrial ecosystems¨ which proposed carrying out visits to protected natural areas where students can learn about the flora and fauna of the place.

And with the aim of making students aware of the importance of protected natural areas. The projects can be viewed in Annex 2. Upon entering block 3 of the technical part of the workshop, a knowledge assimilation questionnaire was implemented where 80% assertiveness in the responses can be observed, as shown in image 4.2.

Questions	# Correct	# Incorrect
Tipos de estaciones de monitoreo	5	1
Los transductores convierten las señales de los sensores en señales eléctricas	5	1
Basan su funcionamiento en la emisión de un haz de luz que es interrumpido o reflejado por el objeto a detectar	5	1
Dispositivo que basa su funcionamiento en un principio óptico al igual que el sensor de material particulado que tiene el dispositivo que armaremos físicamente	6	0
Un microcontrolador es un sistema de procesamiento menos complejo que una computadora	3	3
La oferta de microcontroladores en el mercado es limitado por lo que no es necesario tomar consideraciones al elegir el más adecuado al proyecto	5	1
Selecciona ejemplos de almacenaje de datos de manera remota	6	0
Tecnología que permite la interconexión inalámbrica desde lugares remotos	4	2
La imagen presenta un sistema automático de adquisición de datos de contaminantes.	6	0
La secuencia de observaciones de monitoreo de concentraciones de contaminantes y magnitudes de fenómenos del clima se realiza en series de tiempo	5	1
Total	50	10

Image 4.2. Questions and answers of the third block.

At the end of the third block, an online visit to a monitoring station in Chile was implemented where participants had to find certain components of the monitoring system and describe it. The results obtained can be seen in the images in annex 2b.

In block 4, a shared document was worked on in which the participants explained the importance of measuring pollution (image 4.3). As can be seen in the following image, they accurately define the reasons why it is important to carry out air measurements.

Image 4.3. Purpose of measuring air quality.

In the fourth block we worked on a platform to create your virtual monitor, which was an excellent educational resource.

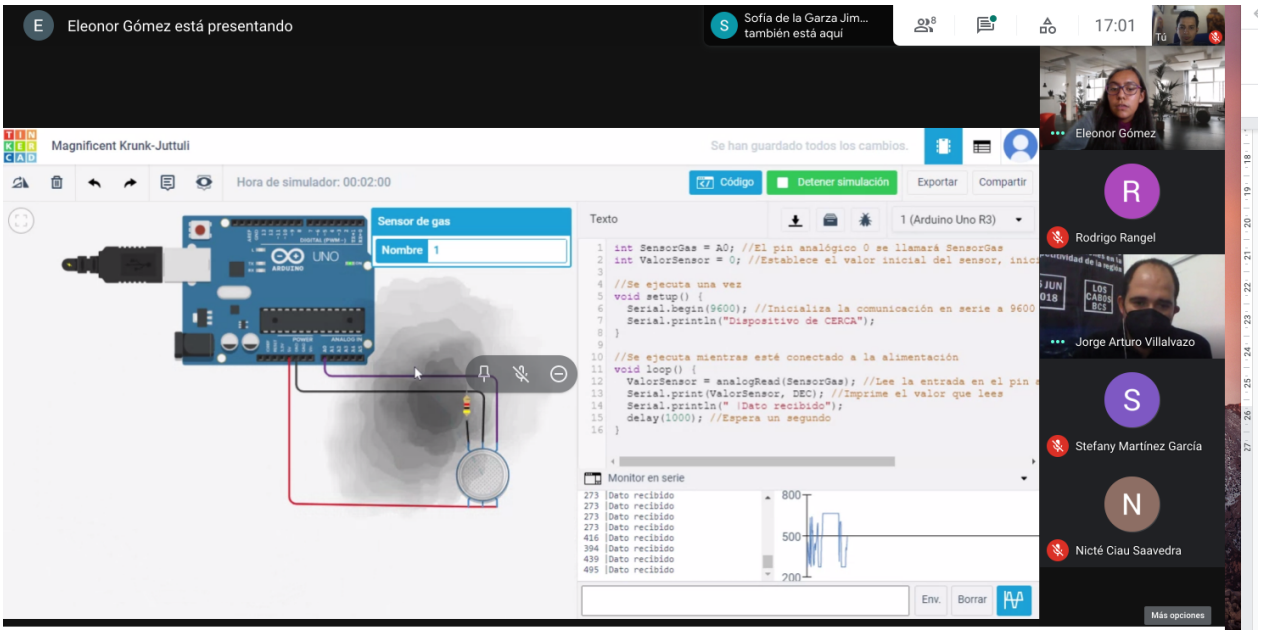

Image 4.5. Tinkercard

In the fifth and final block, we worked with existing monitoring platforms so that participants could observe how the data looks and its usefulness.

In the following image you can see the Lufdaten platform, which was one in which the participants were able to explore and access the data included in the page.

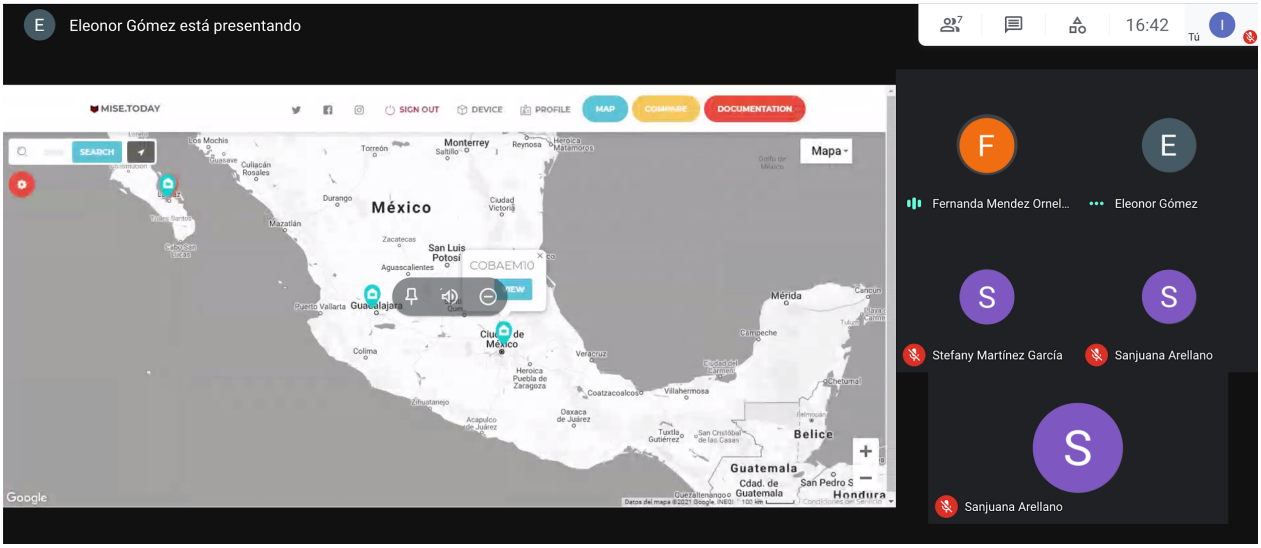

Image 4.6. Plataform Lufdaten

5. Survey analysis

At the end of each block, a workshop satisfaction survey was shared with the participants and in it the general perception of the participants with the knowledge acquired from the workshop could be seen.

Here you can see how 100% of the participants agree that the objective was met (image 5.1a).

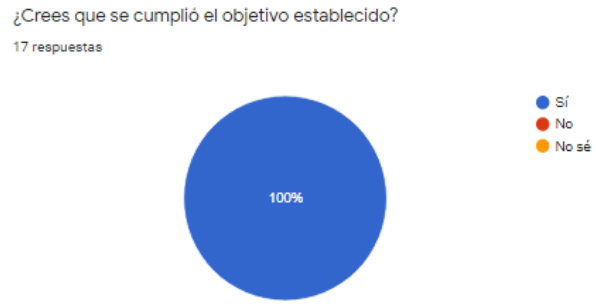

Image 5.1a. Target survey

Image 5.1b. Satisfaction survey

In the image 5.1b you can see how more than 50% of the participants are satisfied with the program, and we believe that the people who marked very dissatisfied could have a reading error because in the last question of any extra comment all the participants share really good reviews.

On the other hand, image 5.2a shows how people considered a high percentage in which the content was either easy to understand or regular, thus demonstrating an opportunity for the students to acquire knowledge.

Image 5.2a. Difficulty survey

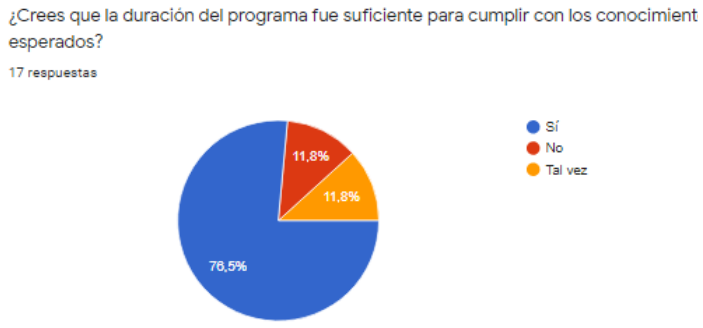

Image 5.2b. Time and knowledge survey

In general, the participants considered that the duration of the program was sufficient to meet their expected knowledge (image 5.2b). More than 50% of the participants think that they would take a course again with us from the 17 responses obtained and shown in image 5.3.

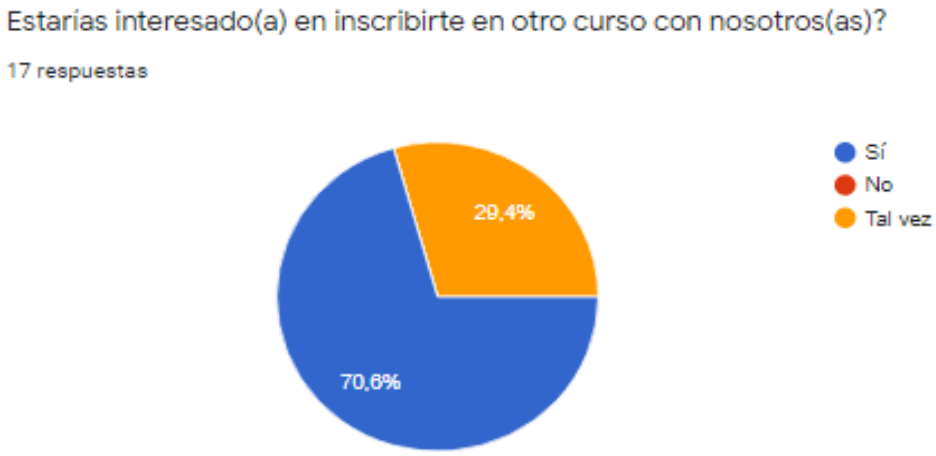

Image 5.3. Interest in more courses with CERCA

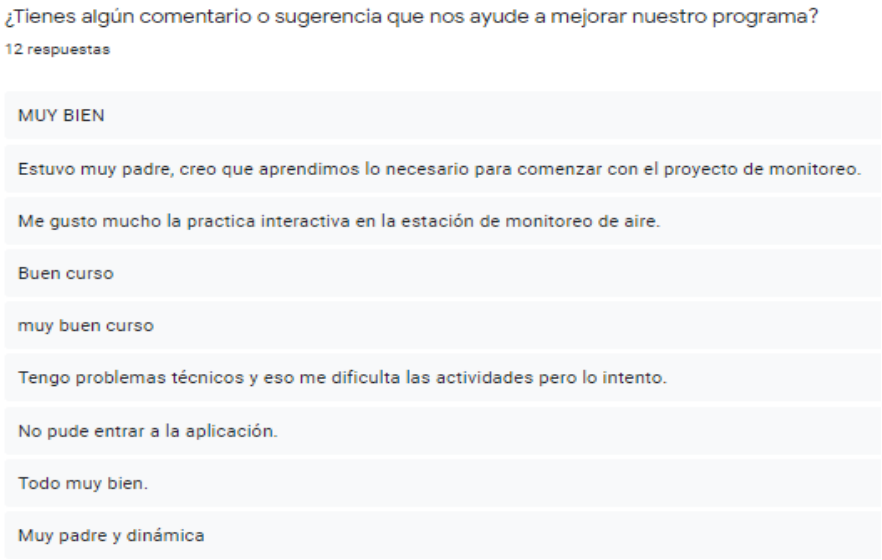

Image 5.4. Additional opinions and comments on the workshop

Image 5.4 shows the comments and suggestions made by the participants. Most were positive comments about the course, some had technical difficulties to carry out activities.

6. Conclusions

The overall workshop was successful and met the objectives for which it was designed. The participants were happy with the results and liked the content. After this first workshop we realized that we could distribute the content in another way since we observed that the time allocated for the connection and installation of the monitors was short, since unforeseen situations arose, such as if you have two different monitors It is necessary to foresee working separately with each one or that not all the participants had physical monitors, so it was necessary to work something extra with the people who did not have it. Therefore, it was decided to redistribute the time to start with the assembly of the physical devices from the first day that the technical part begins, this in the new implementations of the workshop, in order to identify the problems that arise and be able to have the day friday 100% of connected devices. Other than that, the implementation of the workshop went according to plan and was successful.

It is important to note that this is a level 1 course on assembly of monitors than what comes in the white box, since the second model distributed by FWOP requires more time in its assembly and configuration. Therefore, it is concluded that the content and sessions of a course will be focused only on one type of device, it is not possible to carry out a course to configure a “DIY” device (Do It Yourself) and white case in the same workshop.

7. Annexes

Annexes I. Course content

To carry out this workshop, the following course content was designed with their respective times, which is divided by the blocks taught per day, the title of the activity, its description and the respective link or resource to apply.

Bloque (día)	Título	Descripción	Tiempo (Min)
1	Apertura	Presentación y breve descripción del taller, dinámicas, días y horario	10
1	Contaminación	Concepto y tipos de contaminación	10
1	Contaminación atmosférica	Composición del aire, visita al sitio web global.atlas para historia de contaminación, tipos de fuentes y contaminantes primarios, secundarios	30
1	Break	Antes hacer dudas y/o preguntas	15
1	Actividad	Preguntas con herramienta quizizz	10
1	Contaminantes criterio	Clasificación y descripción de cada uno	20
1	Calidad del aire	Conceptualización	15
1	Recolector de partículas casero	Explicación e Inicio de actividad,	5
1	Cierre	Despedida y encuesta	5
TOTAL			120

Bloque (día)	Título	Descripción	Tiempo (Min)
2	Apertura	Presentación y breve descripción de la sesión, dinámicas y horario	5
2	Efecto invernadero	Conceptualización	10
2	Cambio climático	Conceptualización y sectores contaminantes (agricultura, industria, desechos, etc.)	20
2	Consecuencias Calentamiento	Ejemplos	10

	Global		
2	Actividad / break	Preguntas con herramienta quizizz	15
2	Acciones internacionales	Acuerdo de parís, protocolo Kyoto	30
2	¿Como va México?	Situación actual de México	10
2	Actividad	Actividad de objetivos de desarrollo sostenible	15
2	Cierre	Despedida y encuesta	5
TOTAL			120

Bloque (día)	**Título**	**Descripción**	**Tiempo (Min)**
3	Apertura	Presentación y breve descripción de la sesión, dinámicas y horario	5
3	Contaminación atmosférica	Composición, preguntas y repaso	5
3	Calidad del aire	Principales fuentes y efectos nocivos	5
3	Cambio climático	Conceptualización	5
3	Acciones individuales	Ejemplos prácticos y cotidianos de mitigaciones	15
3	Actividad	Calcular la huella de carbono y comentarla	15
3	Break		10
CAMBIO DE PRESENTADORA			
3	Apertura	Presentación y breve descripción de la sesión, dinámicas y horario	10
3	Monitoreo Ambiental	Formas de conocer información de calidad del aire y su monitoreo	15
3	¡Vamos a Chile!	Visita a sitio virtual 360º de caseta oficial, actividad en Jamboard	30
3	Cierre	Despedida y encuesta	5
TOTAL			120

Bloque (día)	Título	Descripción	Tiempo (Min)
4	Apertura	Presentación y breve descripción de la sesión, dinámicas y horario	5
4	Dudas pendientes		10
4	Dispositivos, sensores y datos	Conocer instrumentación necesaria para comprender el funcionamiento de un sistema de monitoreo	20
4	Actividad	Challenge, preguntas con herramienta quizizz	15
4	Break	Descanso	10
4	Práctica Virtual	Conectar y programar un sensor para medir la calidad del aire con la herramienta online tinkercad	45
4	Cierre	Despedida y encuesta	5
TOTAL			110

Bloque (día)	Título	Descripción	Tiempo (Min)
5	Apertura	Presentación y breve descripción de la sesión, dinámicas y horario	5
5	Conociendo mi dispositivo	Descripción de cada componente	10
5	Plataformas	Navegar en sitios web con información de calidad del aire y analizarlas	30
5	Detector Casero de partículas	Publicación de experimento en google my maps	15
5	Encuesta	Encuesta de satisfacción	5
5	Break	Descanso	10
5	Registro Mise	Registro de dispositivos de monitoreo con case blanco en plataforma MISE y configuración de dispositivo	30
5	Próximos pasos	Análisis, visualización de datos y comentarios sobre su divulgación	10
5	Cierre	Despedida	5
TOTAL			120

Annexe IIa. Evidence of ODS activities

During session two, with the aim of knowing the concepts of climate change and greenhouse effect, the international strategies for the 2030 agenda were shown. In order to take ownership of the subject, an activity with two sustainable development objectives was used, its results of proposed projects are shown below:

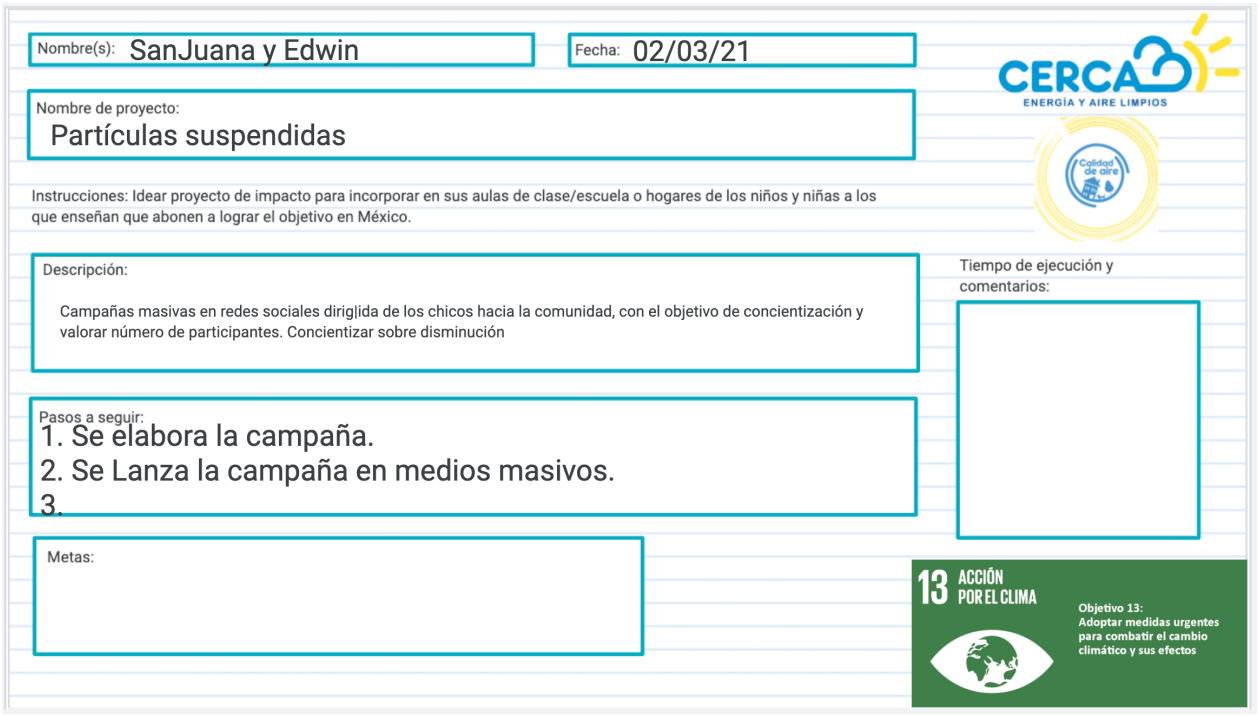

Image 1. SDG 13

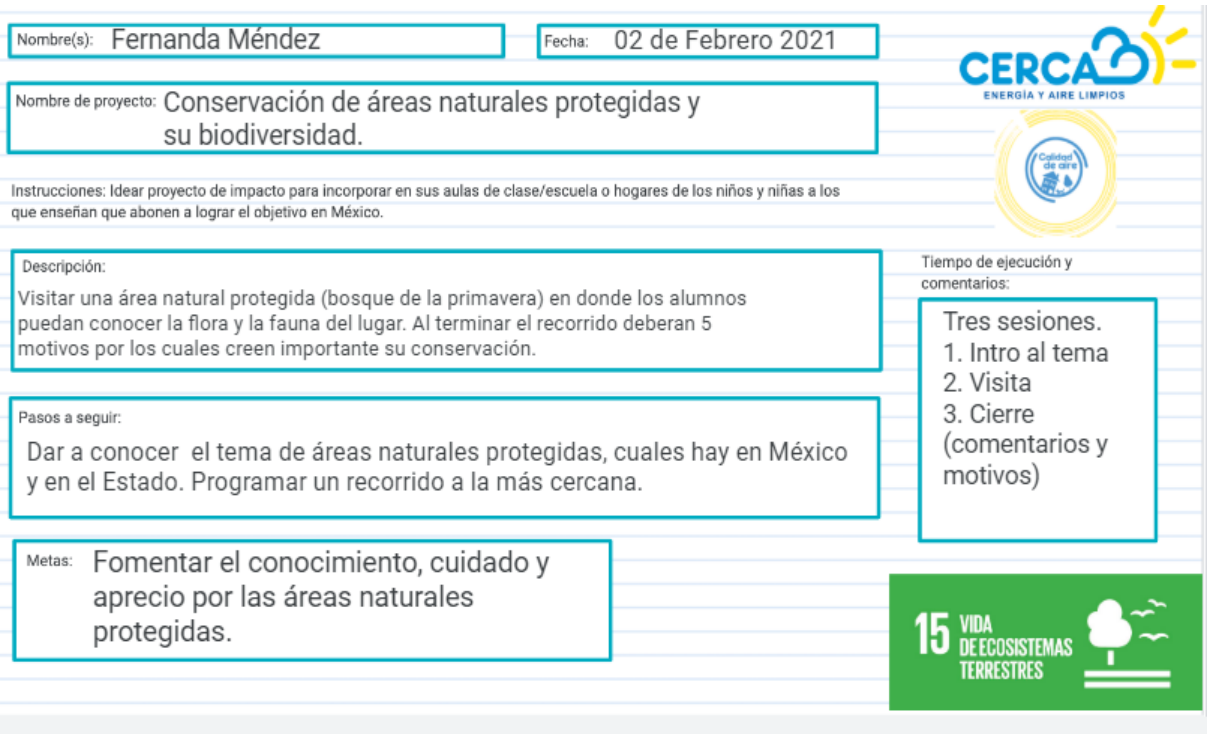

Image 2. SDG 15

Annexe IIb. Graphic evidence from monitoring station

During session 3, a virtual visit was carried out to an official environmental monitoring station, in this case located in the country of Chile. In order to analyze the present components, activities were carried out with the use of the jamboard tool for the participants to search and identify the different teams.

VISITANTES: Prof. Sanjuana
TALLER: Calidad del aire
FECHA: 3/02/21
NO. DE EQUIPO:

ESTACIÓN DE MONITOREO GNL QUINTERO, CHILE

CERCA ENERGÍA Y AIRE LIMPIOS

Instrucciones: Después de explorar la estación, ubiquen los dispositivos encargados de la parte meteorológica, peguen un recorte en el recuadro y contesten las preguntas.

Calidad de aire

SENSORES METEOROLÓGICOS

¿Cuáles son y dónde están?

Sensor de velocidad (Cazoleta)
Sensor de dirección (Veleta)
Se encuentran en la parte alta de la estación.
Equipo MP2 discreta.
Equipo MP10 discreta.

¿Cuál es la importancia de los sensores meteorológicos en estaciones de monitoreo?

La cazoleta· indica de manera indirecta la magnitud de dispersión de los contaminantes. La veleta la migración de los contaminantes.

¿Qué fue lo que más nos gustó de la visita?

La ubicación y distribución que presenta la estación.

¿Qué dudas nos surgen?

Los equipos MP10 y MP2 poseen sensores.

Image 1.Meteorological sensors.

VISITANTES: Prof. Yolanda
TALLER: Taller calidad del aire
FECHA: 03/02/2021
NO. DE EQUIPO:

ESTACIÓN DE MONITOREO GNL QUINTERO, CHILE

CERCA ENERGÍA Y AIRE LIMPIOS

Instrucciones: Después de explorar la estación, ubiquen el sistema de adquisición de datos, peguen un recorte en el recuadro y contesten las preguntas.

Calidad de aire

SISTEMA DE ADQUISICIÓN DE DATOS

¿Cuál es y dónde está? Se encuentra justo entrando a la estación, es una caja blanca

¿Cuál es la importancia del sistema de adquisición de datos en una estación de monitoreo?

Comunican de foma continua la información y de forma automatica.

¿Qué fue lo que más nos gustó de la visita?

Esta estación esta super equipada.

¿Qué dudas nos surgen?

Cual esl medio para la publicación de los resultados

Image 2. Data acquisition system.

VISITANTES: Prof. Mariela
TALLER:
FECHA: 3 de Febrero 2021
NO. DE EQUIPO:

ESTACIÓN DE MONITOREO GNL QUINTERO, CHILE

CERCA ENERGÍA Y AIRE LIMPIOS

Instrucciones: Después de explorar la estación, ubiquen los equipos que miden material partículado, peguen un recorte en el recuadro y contesten las preguntas.

EQUIPOS MATERIAL PARTICULADO (MP 2.5 Y 10)

¿Cuáles son y dónde están?

Equipo MP10 se encuentra de al lado de los equipos de respaldo

El equipo MP2.5 se encuentra a la izquierda de la entrada al lado del respaldo eléctrico.

¿Qué sabemos sobre sus técnicas de funcionamiento?

Mide la variable ambiental minuto a minuto la variable ambiental.

¿Qué fue lo que más nos gustó de la visita?

Todo el recorrido especialmente donde se encuentran

¿Qué dudas nos surgen?

Image 3. Particulate material equipment.

VISITANTES: Prof. Fernanda
TALLER:
FECHA: 03/Feb/2021
NO. DE EQUIPO:

ESTACIÓN DE MONITOREO GNL QUINTERO, CHILE

CERCA ENERGÍA Y AIRE LIMPIOS

Instrucciones: Después de explorar la estación, ubiquen los sensores que miden dióxido de azufre, NOx, monóxido de carbono y ozono en el aire, peguen un recorte en el recuadro y contesten las preguntas.

EQUIPOS SO2, NOX, CO, 03

¿Cuáles son y dónde están?

¿Qué sabemos sobre sus técnicas de funcionamiento?

Miden de forma continua minuto a minuto la concentración en el aire de particulas por billón. El aire se captura a traves de una bomba hasta llegar al equipo.

¿Qué fue lo que más nos gustó de la visita?

Conocer de que manera trabaja cada uno de los medidores de acuerdo a las particulas que miden.

¿Qué dudas nos surgen?

Saber más sobre el proceso de medición.

Image 4. Equipment SO2, NOX, CO, 03

VISITANTES:

TALLER:

FECHA: 03/02/2021

NO. DE EQUIPO:

ESTACIÓN DE MONITOREO GNL QUINTERO, CHILE

CERCA ENERGÍA Y AIRE LIMPIOS

Calidad de aire

Instrucciones: Después de explorar la estación, ubiquen los equipos que miden metano e hidrocarburos, peguen un recorte en el recuadro y contesten las preguntas.

EQUIPOS HIDROCARBUROS

¿Cuáles son y dónde están?

Image 5. Hydrocarbon Equipment.

Annexe III. Air quality web platforms

On day 5, the activity of knowing platforms on air quality was carried out, each participant was assigned different platforms and placed the following observations:

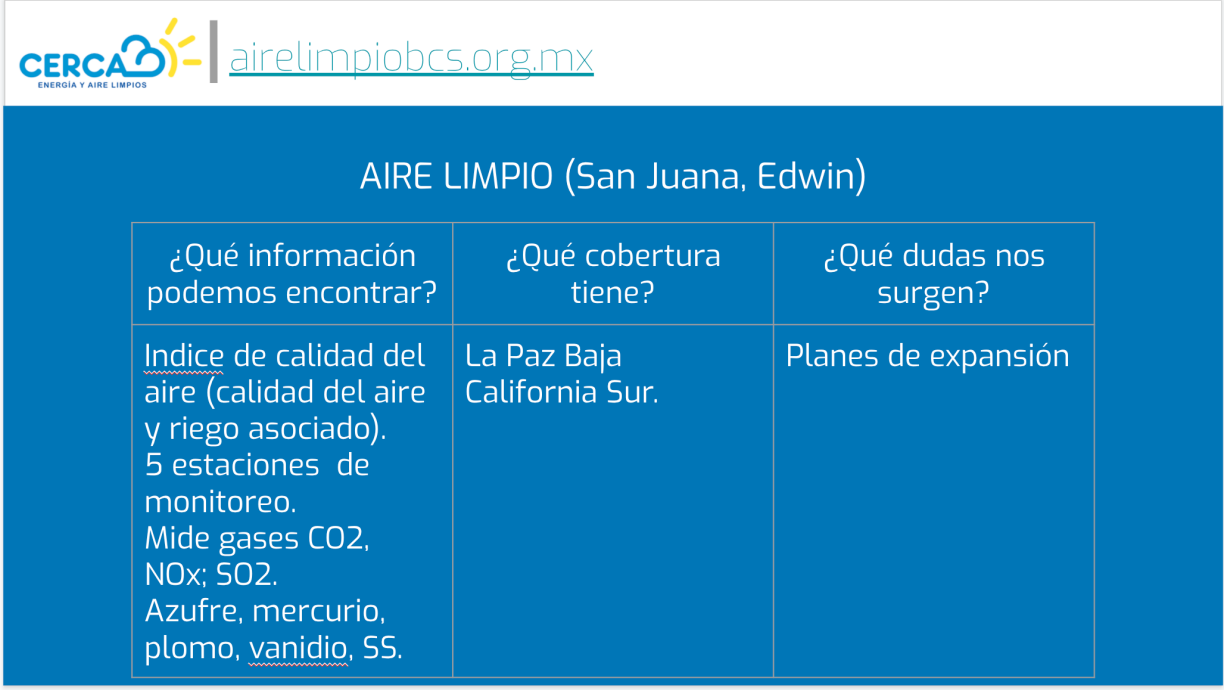

Image 1. Analisys of airelimpiobcs.org.mx

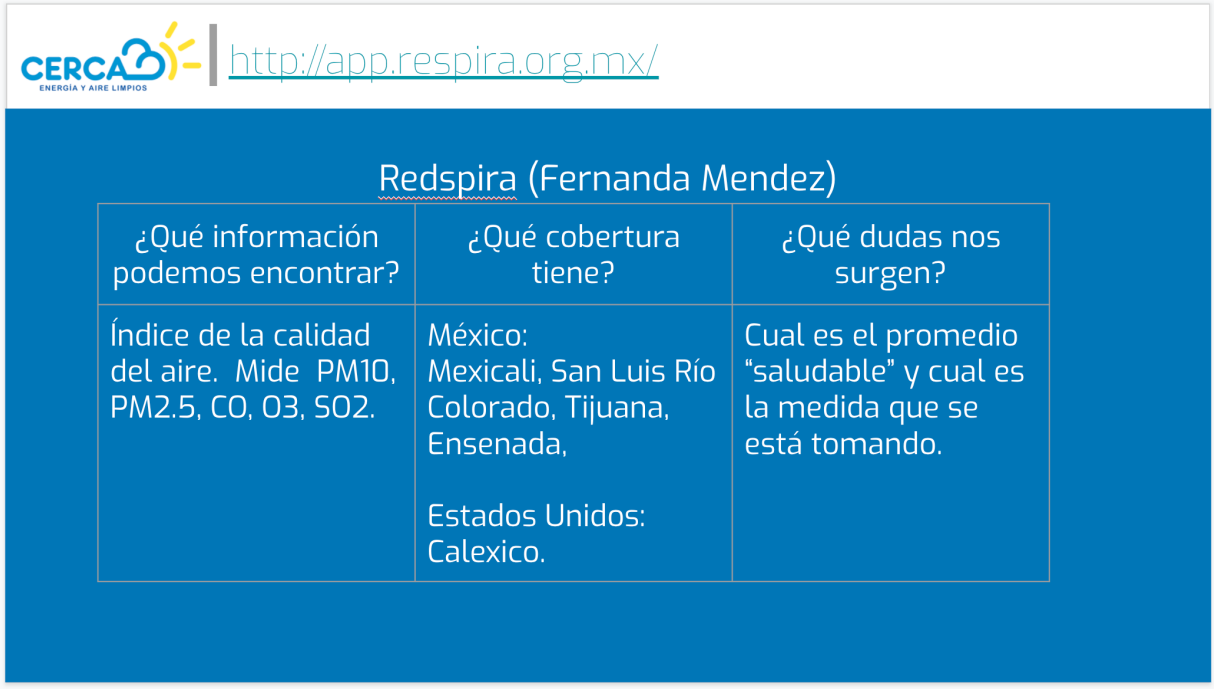

Image 2. Analysis of app.respira.org.mx

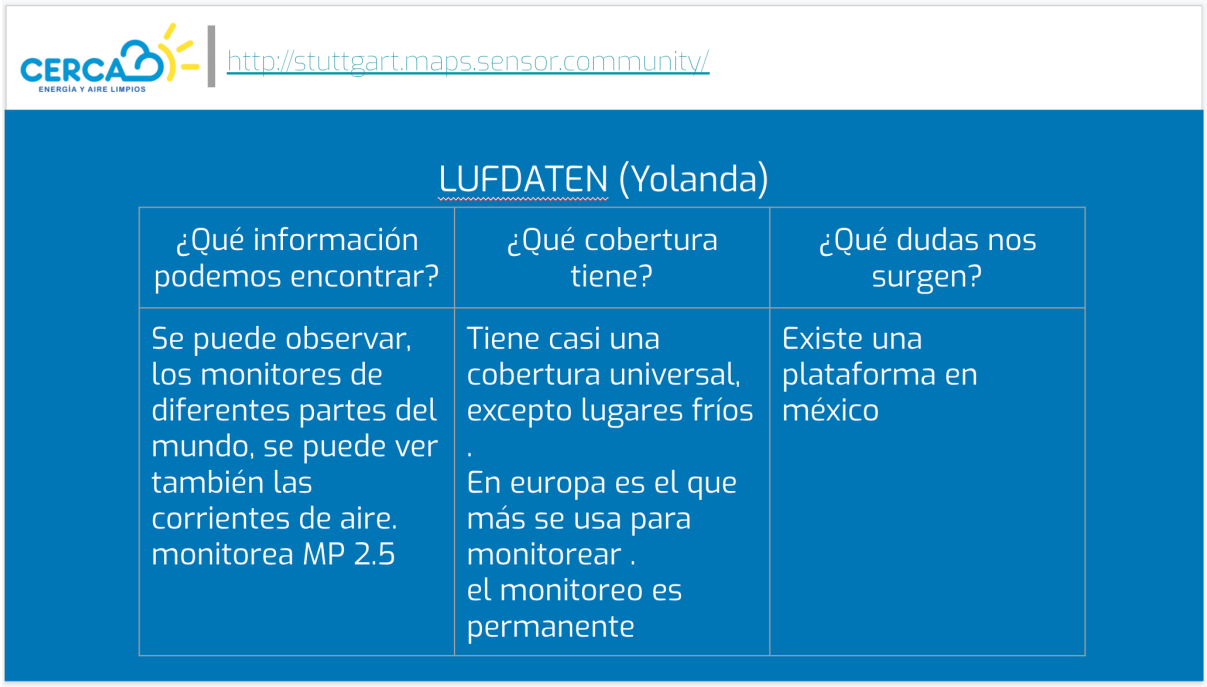

Image 3. Analysis of platform Lufdaten (FWOP)

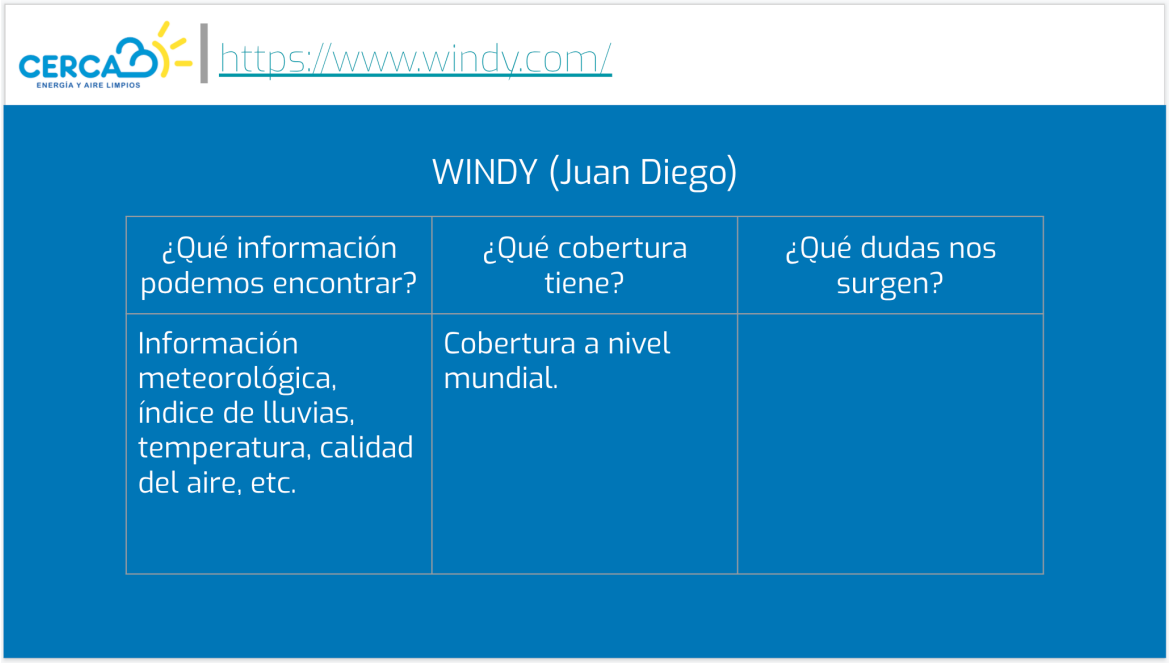

Image 4. Analysis of windy.com

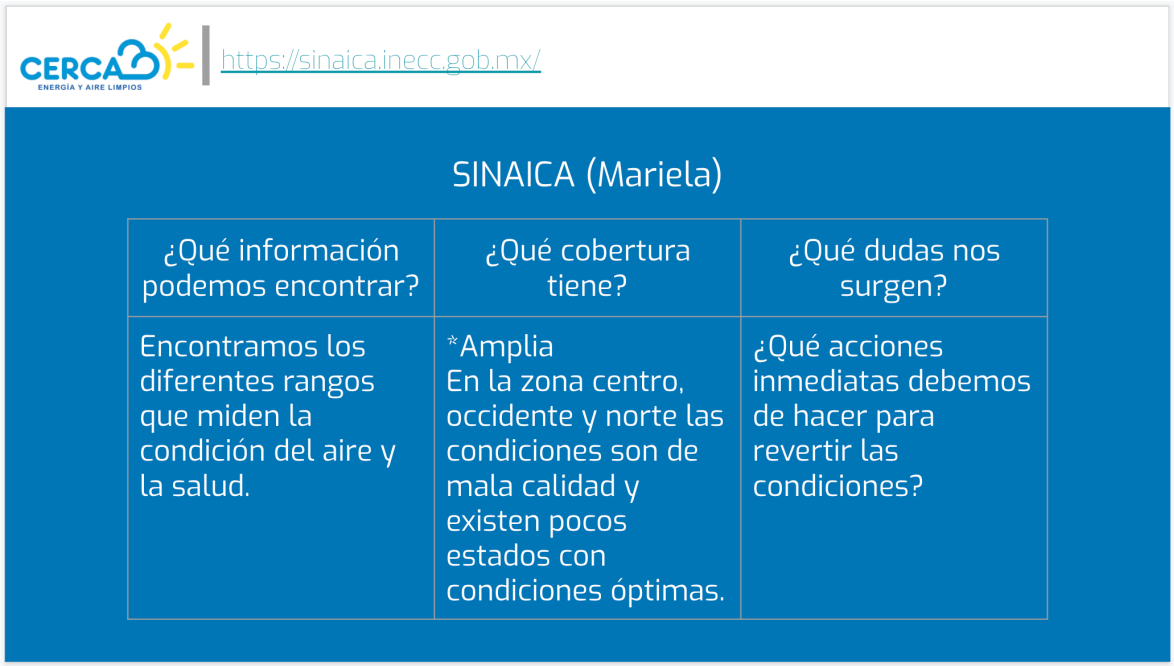

Image 5. Analysis of National Air Quality Information System (SINAICA)

Annexe IV.

The following images were taken as evidence of the workshop implementation process.

Here you can see the first day of the workshop and the introduction of CERCA to the participants.

Image 1. Introduction to the workshop. First day.

Here is the second day of the implementation of the workshop where international actions were discussed.

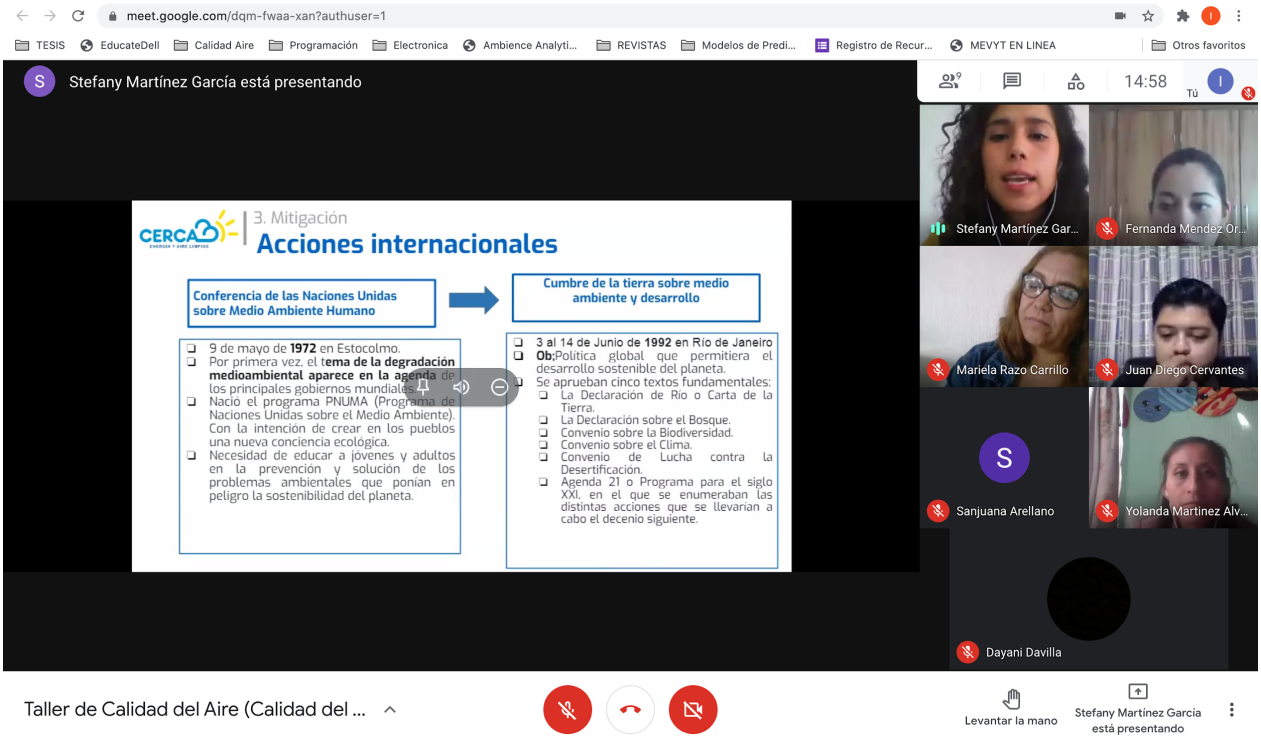

Image 2.Second day of the course.

Annexe IV. Survey results

Student response on the perception of the workshop.

- https://docs.google.com/spreadsheets/d/1D6_yvkAf2krvoztXq_YspjUeXzKBtZ6Nbxec-R_Ar0I/edit#gid=825983750
- https://docs.google.com/forms/d/1hnXokCMR1pSmlY7CBWKOnllgi_76sBREW6HlIaqs2cc/edit#responses