

# **Idle Free Zone**





# Dunboyne Clean Air Campaign

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# **Dunboyne Clean Air Campaign: Project Report**

Dunboyne Senior Primary School is a Healthy Ireland Health Promoting school, an Active school and a Green School. We place a high priority on the promotion of health and well-being throughout our whole school community. We established a STEM team in the school in recent years and this team meets at lunchtimes and works to promote STEM education in our school. Ongoing projects include partnership work with community groups to enhance our local community as a pollinator-friendly environment. We are particularly interested in Environmental Education STEM projects relating to the Global Goals for Sustainable Development and have adopted a multidisciplinary approach to all our STEM projects to ensure that all team members have opportunities to develop individual talents and learn new skills. We are delighted that our school was selected to participate in the Climate Detectives programme. In phase 1 of the Climate Detectives programme we were asked to identify a climate problem that we could like to investigate as climate detectives. We identified a problem based on questions from our school curriculum and from observations of our local school environment. We set about creating an investigation plan for our project. Firstly, we identified our research question which summarised the climate issue that we wanted to investigate. We linked in with as many local, national and international organisations as possible to assist with the implementation of our Investigation Plan for our Climate Detectives project.

This year our school, along with schools across Europe, participated in the GLOBE Air Quality Campaign: An Investigation of Air Pollution Near Schools. Our research question is: How Clean is the Ambient Air in our School Environment? Through this project we have the following objectives: to promote awareness about local and wider air pollution and to explore the links between climate change and unsustainable forms of transport. We also have an objective to educate our school community about the Global Goals for Sustainable Development (SDGs), particularly SDG3 which relates to health and wellbeing for all at all ages. We examined how our actions in our school and community will help to achieve some of these goals. As with our ongoing work on pollinators, we are partnering on this project with neighbouring schools and various community organisations including our local Library, Scouts, Tidy Towns, Rehabcare, local businesses and other community and sporting organisations. We are also partnering on this project with a broader network of organisations to ensure the message has a wider impact: Eco-Unesco, Irish Aid, Asthma Society of Ireland, DCU Open Schools for Open Societies (OSOS) programme, the Tephra Bag Experiment with Trinity College and University College Dublin, Climate Detectives ESA programme, Climate Ambassadors programme, Science Blast 2020, GLOBE programme, GLOBE IVSS and ongoing work with twinning schools: Regio Parco school in Turin, Italy and Passe-Partout school in the Netherlands.

# Introduction

There are often wide variations in local air quality going undetected that can have significant impacts on the health and wellbeing of local communities. Our school is beside a very busy road which our staff and students pass by every day on their way in to and out of the school. We discovered that children are more vulnerable to the effects of air pollution. As a health promoting school, our STEM team decided to investigate the levels of air pollution around our school. The health effects of air pollution are serious – one third of deaths from stroke, lung cancer and heart disease are due to air pollution. Air pollution is closely linked to the burning of fossil fuels and climate change. Air pollution affects children and can have a particularly detrimental effect on children with asthma. As asthma is particularly common in Ireland, where over 380,000 adults and children have the condition<sup>1</sup>, we felt it was important to link our project to the recent Asthma Society of Ireland #OwnOurAir Schools competition which aims to educate young people on the harmful effects that poor air quality has on their health, while simultaneously encouraging students to take action against air pollution.

<sup>&</sup>lt;sup>1</sup> "#OwnOurAir: Schools Competition | Asthma Society of Ireland."

# **Methods and Materials**

We are investigating the quality of the air around our school and are exploring the links between unsustainable forms of transport and climate change. Working with the school STEM team, our pupils are collecting important trafficrelated air pollution data around our school with the research question: How Clean is the Ambient Air in our School Environment? We were given diffusion tubes by the GLOBE programme to measure the average levels of nitrogen dioxide in the air around our school in a four-week period in September/October 2019. Nitrogen dioxide is a pollutant produced by vehicles and some industrial processes. We were surprised at how small the tubes were when they arrived! We installed the three nitrogen dioxide diffusion tubes in three suitable locations around our school including: near a main busy road, at a drop-off parking point and in a sheltered area away from cars and traffic. These tubes were in place in these three locations for 4 weeks and they were then taken down, sealed and sent to a certified lab for analysis with the results of average nitrogen dioxide levels coming back to us via the GLOBE programme. In our STEM class we made predictions about which location would have the highest, middle and lowest levels of air pollution. We researched many aspects of air pollution individually and in groups and we learned about how internal combustion engines work. We looked at how clean the air is in Dunboyne in the EPA Air Quality Index which indicated that air quality is generally 'Good' in Dunboyne. We took the opportunity to talk about our project to as many students and community groups as possible and we developed resources to help spread the word about our project. We participated in Clean Air Week with the Green Schools programme and developed art-work to amplify our message about the importance of clean air to health.



Figure 1: Location of diffusion tube at our local library which is a 'park & stride' school drop off point



Figure 2: Locations of diffusion tubes on our school campus



Figure 3: Busy road intersection outside our school

Our study site is the area around our school; Dunboyne Senior Primary School. Here is a <u>weather report</u> from our nearest Met Éireann weather station at Dunsany, Co. Meath. In Dunboyne, the summers are comfortable and partly cloudy and the winters are long, very cold, windy, and mostly cloudy. Our climate in Dunboyne has a warm season which lasts for 3.0 months from June 11 to September 11 with an average daily high temperature above 17° celcius and low of 11.6° celcius. The cool season lasts for 4.1 months from November 15 to March 17<sup>th</sup> with an average daily temperature below 10° celcius<sup>2</sup>.



Figure 4: Study Site

<sup>2</sup> <u>https://weatherspark.com/y/33843/Average-Weather-in-Dunboyne-Ireland-Year-Round</u>

# **Results from October 2019 readings**

Our results from October 2019 were somewhat surprising: the measurement at the sheltered area at the back of the school (16.40  $\mu$ g/m3), was slightly higher than the measurement from the school drop-off point at the local library (15.34  $\mu$ g/m3). The result for the 'Near a busy road' reading was the highest of the three readings at 20.27  $\mu$ g/m3. We compared the results from our school with those of the other schools in the programme (see figure 7) and also compared our results with those schools in the 'Town 5,000 to 9,999' population category (see figure 6). We found the sharing of data from all participants in the GLOBE programme to be very beneficial to our broader understanding of air pollution in terms of population size, location etc (see Figures 6 & 7). We also found quite useful the provision by the GLOBE programme of a table to explain the findings in simple terms for use in presentations to community partners etc (see Figure 8).



Figure 5: Average nitrogen dioxide levels for Dunboyne Senior Primary School October 2019



Figure 6: Measurements from GLOBE Oct 2019 participants in the 'Town 5,000 - 9,999 category'



Figure 7: Results of all participants in the GLOBE air quality survey Oct 2019: Readings at a busy road

NO2 concentration (µg/m3)	Description
50 +	Extremely bad
45 - 50	Very bad
40 to 45	Bad
35 - 40	Substandard
30 - 35	Mediocre
25 - 30	Average
20 - 25	Pretty good
15 to 20	Good
10 to 15	Very good
0-10	Excellent

Figure 8: Table provided by GLOBE to explain average nitrogen dioxide readings in terms of air quality

# **Discussion**

As part of our STEM activities we made predictions at the start of the project about what the results might be. When the results came back we were surprised at the results for the sheltered area at the back of the school which was higher than the result for the school drop off area. It is possible that the proximity of that location to the staff car park and church car park may be a factor. We have since erected 'No Idling' signage in the school car park and around the school and have informed the bus drivers using the car park of our project objectives. The highest recording of nitrogen dioxide (20.27 µg/m3) met our STEM class predictions; we predicted that the reading at the busy road would be the highest. From our analysis of the results from all schools involved in the project and those in the 'Town 5,000-9,999' category, we saw that our school results came about in the middle of the overall results which means that there is definite room for improvement in our local air quality. We realised that while our results were not the highest from among all participants in the programme, we could certainly improve the air quality in our school. Based on the above results and analysis, we launched an air quality campaign #DunboyneCleanAir to encourage our school and wider community to do the following:

- Walk, scoot or cycle to school (This is proven to be good for health and student concentration levels too)

- Park + Stride (our school has designated drop off points in the local community)

- Always turn off engines when parked (No Idling Poster campaign throughout Dunboyne)

- Raise awareness of the risks to health associated with air pollution.

STEM team pupils visited classes in the school to raise awareness of the research project. We created an information notice board in the school hall and invited classes to post messages and artwork on the school notice board to celebrate National Clean Air Week (see Figure 11). We were delighted with the excellent responses from all the classes. We also discovered some very helpful tips to promote our key messages about the importance of having clean air in our school and local environment. We informed Dunboyne Tidy Towns about our research project and they were fully supportive of our project and have greatly helped us to access resources and to forge links with our local and wider community. This has helped us to reach out to organisations such as our local GAA club, Dunboyne Athletics club, Dunboyne Soccer club, Dunboyne Scouts, Dunboyne Community Centre, Dunboyne library, Rehabcare, local businesses, schools, second and third level colleges and more. All of these organisations are supporting our clean air campaign and the "Idle Free Zone" posters we developed based on student art-work are displayed in key locations including at neighbouring schools, the playground car park, third level college, the doctors surgery, pre-school, local library and businesses around our community and by the above community groups (see Figures 12, 13, 14). In association with Dunboyne Tidy Towns, we launched our Clean Air campaign in our school hall and classes in the school were invited to a presentation along with representatives from our local and wider school community. It was a wonderful opportunity to share our project with our community (see Figures 9 & 10). We adopted the Open School model where pupils' projects meet real needs in the community outside of school. They are presented publicly and draw upon local expertise and experience. This fosters learner independence and interdependence through collaboration, mentoring and through providing opportunities for pupils to understand and question their place in the world.



Figure 9: Our launch day 4th Feb 2020 with student and community representation



Figure 10: Our launch day 4th Feb 2020 with student and community representation

We created a research poster which will be displayed on the Globe website thus ensuring that our project reaches a wider audience (see Appendix III). We have also submitted this report to the GLOBE International Virtual Science Symposium (IVSS). We are a champion school for Open Schools for Open Societies and will be sharing our project on the OSOS European portal (see Appendix II). Our project has been selected for the Climate Detectives Competition 2019/2020 (ESA) and we look forward to sharing our project on this portal. We are engaging with the Climate Detectives competition and were due to participate in a webinar with Mr. Thorsten Fehr, Head of Atmospheric Section at European Space Agency (ESA) on the 10th March 2020, however, this was postponed due to the COVID-19 crisis. We hope to have further opportunities to interact with the Climate Detectives programme and to discover more about the connections between our changing climate and air pollution. We also look forward to sharing our projects from across Europe already on display on the Climate Detectives website<sup>3</sup>. We exhibited our project at the Science Blast national exhibition at the RDS Dublin on the 3<sup>rd</sup> of March (see Appendix I)) and thirty of our students were able to attend the exhibition and interact with the judges and other exhibitors. We will be submitting our project to the Discover Primary Science and Maths award in association with Science Foundation Ireland.



Figure 11: Our Clean Air Week Poster, Nov 2019



Figure 12: Samples of our 'No Idling' Resources

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Figure 13: Samples of our 'No Idling' Resources



Figure 14: Examples of our 'No Idling' posters in place in our community at a playground, library and GP surgery

# How our project has made a local and wider impact

Our school is a Healthy Ireland Health Promoting school, an Active School and a Green School. We place a high priority on the promotion of health and wellbeing throughout our whole school community. Having considered the impacts of air pollution on health and especially on the health of children and people with asthma and other conditions such as cardiovascular and respiratory diseases, we decided to gather local data to determine the quality of the air that we breathe each day with the research question: How Clean is the Ambient Air in our School Environment? We considered that what can be measured, can be managed and that armed with scientifically accurate data on the quality of our local air, we could share this information with our school and wider community in order to bring about behavioural change. Ireland's population is particularly affected by asthma with 380,000 people in Ireland currently diagnosed with the illness. We considered that a school-led campaign to raise awareness about the importance of air quality could have a wider impact if shared both locally and through wider channels. To achieve this we made efforts to recruit local partners to promote our air quality campaign; #DunboyneCleanAir. Our local partners include the following: neighbouring schools and various community organisations including Tidy Towns, Rehabcare, local businesses, our local GAA club, Athletics club, Soccer club, Scouts, Community Centre, Dunboyne library, Rehabcare, local businesses, second and third level colleges and more. We also took opportunities to inspire and inform a wider audience through various channels such as at Science Blast 2020, through the GLOBE IVSS, Open Schools for Open Societies and through the Climate Ambassadors programme, the Climate Detectives Programme, The Tephra Citizen Science Experiment, the Eco-Unesco Young Environmentalists Award for which we have reached the list of finalists. We have also participated in the Irish Aid Awards. We spoke on local radio, LMFM, on Feb 18<sup>th</sup> highlighting our project (see figure 17). This broadspectrum approach will help ensure that our project has both a local and more global impact.

On April 22<sup>nd</sup>, we received notification that our project was one of a final eight projects from across Europe to be considered for a GLOBE IVSS award for achieving 4 stars <sup>4</sup> and that our school had achieved three virtual badges for our air quality project in the GLOBE International Virtual Science Symposium (see figures 15 & 16). We received very positive written feedback from the IVSS judges (see Appendix V). We were thrilled to reach the list of national finalists in the Super Junior category of the Young Environmentalists Awards.

<sup>&</sup>lt;sup>4</sup> <u>https://www.globe.gov/news-events/globe-events/virtual-conferences/2020-international-virtual-science-symposium/rubrics-and-badges</u>



Home > Europe and Eurasia > Ireland > Dunboyne Senior Primary School > About & Contacts

Share





We think it's a great idea! Dunboyne groups have rallied around for clean air in the village. #latelunch #dunboyne #cleanair





Figure 17: Local Radio LMFM on February 18th



Figure 18: Young Environmentalist Awards Ceremony

# **Our Students as STEM Storytellers**

Our school has been invited to participate in the research study "An Investigation into sustaining open schooling collaborations in STEM Education" which is being carried out in 100 Irish schools. Students (aged 10-12 years) develop scientific skills to solve real-world environmental issues in their community and in a global context. Our students have examined the following; the health effects of air pollution, the links between air pollution and climate change, how children are particularly affected by air pollution and how human activities are impacting on air quality locally, nationally and globally. Students engage with the scientific method in this inquiry-based activity in the school and the local and wider community and are encouraged to take ownership of the project. They develop leadership and communication skills by engaging with the GLOBE program, Climate Detectives (ESA), the school community and Dunboyne Tidy Towns in a common goal. By working with their families and community and sharing their work, students bring science and STEM education to the community. Students present their projects in the school, on the school website, on the GLOBE website and at the ECO-UNESCO Young Environmentalists Awards which was due to take place in late March 2020 but was postponed. Students hosted an open science day in the school to launch our #DunboyneCleanAir campaign in association with Dunboyne Tidy Towns. Students adopt an interdisciplinary approach to the research project as our STEM team members investigate the levels of air pollution in and around our school. Students record their investigations through photography, art, writing, poetry, digital logbooks, PowerPoint and iMovie. Students participate in The Tephra Citizen Science Experiment with the research question: Can use of volcanic ash reduce the amount of CO2 in the air? This project explores the possibilities of negative carbon emission technology for climate change in association with Trinity College, Dublin and University College Dublin.

Students and student involvement are integral to this project. Students designed posters with a particular focus on idling cars to raise awareness of this important health promotion initiative and the posters are placed in prominent locations in our community with the support of parents, the Parents' Association, neighbouring schools, our local Library, Scouts, Tidy Towns, Rehabcare, local businesses and other community and sporting organisations. Students also shared their project at a national science exhibition, Science Blast in early March 2020, receiving very positive feedback from the exhibition judges.

# How our Interactions with STEM professionals have enhanced our project

The subject of 'air pollution' was a new one to us and early on in the project we felt that gaining the input of various professionals would be of benefit to us in ensuring that we took our project in a positive direction. We wanted to broaden the scope of the project beyond the local to place the issue of air pollution within a broader context of, for instance, climate change and unsustainable forms of transport. To achieve this objective we applied to get involved with the European Space Agency's Climate Detectives programme. We were delighted to be accepted onto the programme and, after submitting a progress report on our project, we received valuable feedback from a scientist, Mr. Thorsten Fehr, who is working on atmospheric satellite projects at the European Space Agency's centre in the Netherlands. The feedback directed us to consider for instance the transport of nitrogen dioxide from the centre of Dublin and nearby industrial areas, smaller power plants etc. The feedback highlighted the impact that even long-range transport from the UK can have on local air quality and urged us to consider keeping a register of local weather and Easterly winds. We were directed by this feedback to further sources of information such as the Copernicus Sentinel-5P satellite which is measuring nitrogen dioxide and other pollutants from space and also to the European Environment Agency Air Pollution monitoring programme.

We were due to participate in a Climate Detectives webinar on March 10<sup>th</sup> and had submitted a question for consideration at the webinar based on our research; What are the connections between our changing climate and air pollution? The webinar was postponed due to COVID-19, however, we look forward to participating further with the Climate Detectives team in the future. We have found the engagement with scientists on the Climate Detectives programme to be very beneficial in broadening the scope of our project and in placing our project within a wider context of climate change, long range air pollution, unsustainable forms of transport etc. We also felt that our work to promote local air quality and encourage behavioural change within our community was validated by the positive words we received from the ESA scientist as they urged us to 'talk to as many people as possible' about our experiment.

We had a workshop from Gerry Murphy, a meteorologist with Met Éireann, Ireland's meteorological service, in March and used the opportunity to ask questions based on our project and the connections between air pollution and weather. Our interaction with Gerry Murphy was particularly beneficial in that it pointed us to an issue that had been puzzling our team; how were our readings for average nitrogen dioxide levels slightly higher in the 'sheltered area' at the back of our school compared to those from the 'drop off area' which sees a lot of car traffic every day (see Figure 5). Gerry suggested that the 'sheltered area', which is between the Junior School and the Senior School buildings, might have acted as a 'trap' or 'pocket' for the air pollution with little chance for air to circulate and disperse the pollutants. This interaction with a STEM professional enhanced our understanding of our project data.

We are pleased to have had further interaction with a STEM professional through our involvement with the Tephra Bag experiment (see Appendix IV). The Tephra Bag experiment focuses on a citizen science research that involves the development of a volcanic ash 'tea bag' kit necessary for a preliminary experiment that will be carried out by the general public. The project aims at collecting data on chemical weathering of volcanic ash concerning different Irish soil types as a new carbon-emissions reducing technology. It aims at engaging with the members of the public (primary school children and families) and educating citizens on the possible reduction of carbon dioxide in the atmosphere. We had a workshop with Kamila Kwasniewska and Dr Anthea Lacchia from UCD who delivered a powerpoint presentation and two demonstration workshops on how to carry out this citizen science workshop including taking soil and water samples which the STEM team have taken ownership of as a weekly task. We received very positive feedback on our Science Blast exhibition on March 4<sup>th</sup> from Dr Nicola Broderick and Peter O'Hagan, Science Blast judges. The feedback praised our project and research question as being very relevant to today's society and highlighted our stakeholder engagement as beneficial to the reach of the project. Students who spoke to the judges were identified as being 'clearly passionate' about the subject matter. We received further positive feedback from the GLOBE IVSS judges which was addressed directly to the most important people in our project; our STEM students. See Appendix V for the text of our feedback from the IVSS judges.

# Conclusion

We want this investigation to be empowering and inspiring and are sharing our findings and solutions through a variety of means including; as a research poster on the GLOBE website, Dunboyne Tidy Towns Facebook page and Information Hub, the Young Environmentalist Awards, Asthma Society of Ireland #OwnOurAir schools programme, Climate Detectives 2019/2020, the Open Schools for Open Societies European Portal, the Climate Ambassador Program (An Taisce Education Unit), Irish Aid Awards, Discover Primary Science and Maths awards, the GLOBE IVSS and at the ESB Science Blast Expo in March 2020. The investigation provides a valuable opportunity for our school to collect local data, analyze scientifically accurate data and to share solutions to improve air quality locally and nationally. The project links to the strand "Environmental awareness and care" of Social Environmental and Scientific Education in the Irish Primary School Curriculum. We repeated the measurements in February 2020 to see if our campaign has helped to

improve air quality in our school and local environment and the results are below. Before the closure of our school in mid-March due to the COVID-19 crisis, we were also considering the role of weather and had begun an investigation into how this variable can impact our readings. Mr. Gerry Murphy, a meteorologist with Met Éireann, Ireland's meteorological service, visited our school to meet with the STEM team and deliver a workshop on this subject on March 4th. We enjoyed sharing our project with him and gained a better understanding about the links between weather and air pollution through participating in this workshop. Our school remains closed since March 13<sup>th</sup> due to the Covid-19 emergency. A brief comparison between our October 2019 and the February 2020 readings and further brief analysis is below and our February results are also presented in an updated research poster in Appendix III. We are working in the background while our school remains closed and students are participating in events such as the GLOBE webinar and are submitting videos on the project as part of their homeschooling. Once schools reopen, our intention is to re-engage with the school and wider community on this project.

# Comparison between October 2019 NO2 readings and February 2020 readings

Our school had a second opportunity to measure average nitrogen dioxide levels in our school environment in February 2020. The GLOBE Programme provided us with 3 more diffusion tubes to install in the same three locations to again measure average nitrogen dioxide levels. Our awareness campaign #DunboyneCleanAir was launched in early February in our school and a presentation was given to all third and fourth classes and to representatives from our community (see Figures 9 & 10). The tubes were in place for two weeks and were taken down before the mid-term break. During this time our STEM team continued with work to engage with the community and our posters were installed at numerous locations around our community including at local schools, the playground, library, credit union, scouts den, soccer club, running club, local businesses, at a local GP surgery and more. We also spoke on local radio, LMFM, about our project. A video we produced about our project was featured at a GLOBE webinar and on EPA Ireland social media and can be viewed at this link. See Figure 19 below.



The GLOBE citizen science campaign held an end of year celebration last week with presentations from students and their teachers, as well as a contribution from NASA Scientist, Michael J Garay. Watch the video about the Dunboyne Senior Primary School project @GreenSchools



Figure 19: EPA Ireland social media coverage of our campaign



Figure 20: Comparison figures: Oct 2019 and Feb 2020 average NO2 levels Dunboyne SPS

Dunboyne Tidy Towns were crucial partners in our efforts to reach a wider audience with our project and we were delighted with the positive responses we received. The readings were returned to us in late March 2020. See Figure 19 for a comparison chart between our October 2019 and February 2020 readings. The NO2 Concentration ( $\mu$ g/m3) readings for the sample near a busy road have increased from 20.27 to 21.90. The two other readings have also increased from 15.34 at the school drop off point to 17.79 and from 16.40 in the sheltered area to 17.12 NO2 Concentration ( $\mu$ g/m3). We were provided with a mean figure for all schools to have engaged with the GLOBE February 2020 campaign. We found this very useful to be able to compare our most recent readings with the mean figure from all February participating schools; see Figure 20. Our readings were above the mean average figures in all three cases.



Figure 21: Comparison between Dunboyne SPS NO2 average and mean figure for all schools who participated in the GLOBE Feb campaign

We also compared our average readings from the national figures for a 'busy road' from the GLOBE February campaign; see Figure 21. We found the provision by GLOBE of figures from other participating schools to be very useful to our understanding of the readings. From our analysis of the recent figures, we feel that our continued engagement with #DunboyneCleanAir is crucial to improving the air quality in our local community. Preliminary research<sup>5</sup> is emerging on the links between higher rates of COVID-19 deaths and high levels of air pollution, further reinforcing for us the importance of clean air for our community's and for global health.



Figure 22: Readings from all participating schools in the Feb 2020 GLOBE Programme air quality test

# **Appendices**

# Appendix I: Our Science Blast 2020 Stand, March 3rd 2020



# **Appendix II: Our Research Poster for OSOS**





unboyne Clean Air Projec Caitríona Lordan Dunboyne Senior Primary School



#### Abstract

The Dunboyne Clean Air project is an environmental education STEM project. Students( aged 10-12 years) develop scientific skills to solve real-world environmental issues in their community and in a global context. The health effects of air pollution are serious - one third of deaths from stroke, lung cancer and heart disease are due to air pollution. Air pollution is closely linked to climate change. Air pollution affects children because their lungs are still developing.Students investigate how human activities are impacting on air quality locally, nationally and globally. Keywords : Air quality ; Ambient

air ;ecosystems; Nitrogen Dioxide; Carbon Dioxide ;Emissions;

#### Description

Placed: Students engage with the scientific method in this inquiry based activity in the school and the local and wider community.



Purposeful :Students recognise that air pollution can impact on human health, ecosystems and vegetation. Actions to improve air quality can have a positive global impact.



Passion-led: Students are encouraged to take ownership of the project. They develop leadership and communication skills by engaging with the GLOBE program, Climate Detectives (ESA), the school community and Dunboyne Tidy Towns in a common goal . Pervasive: By working with their families and community, sharing their work, students bring science and STEM education to the community. Students research and measure air pollution in the school and local community and consider the impacts in a global context. Students identify problems, engage with local national and international organizations, discuss their thoughts in groups, and devise a plan of action based on scientific evidence.

Feel

Students engage with their peers, families, local and national organizations including Met Éireann to implement a plan of action. Students commit to raising awareness of the problem and offering possible solutions. The project is featured on local radio.

Imagine



Create

Students adopt an interdisciplinary approach to the research project.Our STEM team investigate the levels of air pollution in and around our school. We participate in the GLOBE Program along with 38 other Irish primary and secondary schools and hundreds of schools across Europe to measure the air quality in our school environment.We partner on this project with Climate Detectives (ESA), the Climate Ambassador Programme (An Taisce) Irish Aid Awards ,ECO-UNESO awards, The Asthma Society of Ireland, neighbouring schools, our Library, Scouts, Tidy Towns, Students record their investigations through photography, art, writing ,poetry, digital logbooks, PowerPoint and iMovie .Students participate in The Tephra Citizen Science Experiment- Can use of volcanic ash reduce the amount of CO2 in the air? - exploring the possibilities of negative carbon emission technology for climate change in association with Trinity College, Dublin and University College Dublin to explore solutions.



#### Share

Students present their projects in the school, the school website, GLOBE website and at ECO-UNESCO Young Environmentalists Awards. Students host an open science day in the school to launch our # Dunboyne Clean Air campaign in association with Dunboyne Tidy Towns .Students design posters with a particular focus on idling cars to raise awareness of this important health promotion initiative. Posters are placed in prominent locations in our community with the support of parents ,Parents' Association, neighbouring schools, our local Library, Scouts, Tidy Towns, Rehabcare, local businesses and other community and sporting organisations Students share their project at a national science exhibition.



# **Appendix III: Our GLOBE research posters**



# Research poster below is updated with February 2020 comparison figures



# **Appendix IV: Tephra Bag Experiment Poster**

# The Tephra Bag Citizen Science Experiment

Can use of volcanic ash help to reduce the amount of CO<sub>2</sub> in the air?

Primary School Science Project for Fifth and Sixth classes





Tephra is volcanic ash that has a potential of capturing  $CO_2$  from the atmosphere in a process called **chemical** weathering. Tephra could be a potential geological-based solution for **climate change** by reducing the greenhouse gases in the atmosphere.



Citizen Scientists are volunteers who collaborate with a scientific process by collecting data. They observe and record information about the natural world and contribute to a growing need for environmental data.

#### Overview

At Trinity College Dublin, we are investigating the potential of plant-enhanced chemical weathering by **burying the teabag** with volcanic ash in a local soil together with planted ryegrass.

This citizen science project is directed to pupils in fifth and sixth class and aims to educate the general public – teachers, primary school children and their families about the possibilities of negative carbon emission technology for climate change!

We invite you to take part in this exciting experiment!

#### Details

To execute the experiment, your class will receive a toolkit that contains:

- A 3D volcano box with a volcano diagram
- Protocol booklet with the experimenexplanation
- 4 pots
- Volcanic ash in teabags
- Ryegrass seeds
- Water measuring mug
- A sensor that can measure soil moisture temperature and pH

#### Curriculum coverage

Participation in this citizen science experiment will cover a range of subjects from the Science and Geography Curriculum that are included in the following Strand Units:

- Rock and soil
- Weather, climate and atmosphere
- Light
- Caring for the environment
- Plant and animal life



Project will run for 3 month starting March 2020.

#### For more details please contact:

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# **Appendix V**

#### GLOBE IVSS - Judge Comments:

Dear (Students' names), with the quality of the ambient air around your school, you have chosen an important research topic which affects your and everybody's health. You have identified a source of air pollution. It's the cars that often idle and stink at traffic lights. And you have also discovered one of the dangerous substances that cars emit. It's nitrogen dioxide that you measured with the small diffusion tubes. Your information panels for drivers on the subject of idling are really impressive and should have convinced at least a few to turn off the engine at the traffic lights or at the drop off point, right?

I really liked that you placed the diffusion tubes in different distances from the road. The fact that your measurements did not fully correspond to the working hypothesis is not too bad. On the contrary, you had to consider why the tube farthest from the road contained that much nitrogen dioxide. I think your considerations and discussions on this are good.

What would interest me from you: wouldn't it be interesting to know whether your great information boards really have an effect on drivers and thus on air quality? Your second measurement in February should perhaps have provided an answer to this question. If little has changed, are there any other ways to convince drivers to idle less at traffic lights? And what can you yourselves change in your life to improve air quality?

Important project, involved the community around scientifc research about world problem. Concise and eficient public material.

Air quality is important for the health of us humans but also for all other living beings. You have dealt with the subject according to clear scientific methods, you have come up with a good question and a suitable hypothesis. You also informed the people in and around your school building about the problem of idling, especially the drivers. You have told an easily understandable story from your research project and presented it on a clearly structured poster - great!

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