Air pollution on a small island:

A study on air quality

Abstract

An Air Quality Campaign was carried out between the 17th of October and 14th of November 2022. The main aim was to investigate air quality in different locations around Gozo. Air pollution is an environmental concern which varies from one location to another due to several factors such as transportation, energy production and population density. Poor air quality can lead to health issues especially those related to respiratory and cardiovascular. According to statistics published during 2022, eight of Malta's main roads exceeded the limit set by the EU on air pollution. The Environment Minister Miriam Dalli pointed out that the least polluted streets are in Gozo with the exception being Republic Street in Victoria. Sir M.A. Refalo Sixth Form is located in this area.

Keywords: air quality, transportation, energy production, population, respiratory and cardiovascular health issues.

Research Questions

- What are the levels of nitrogen dioxide in front of the school?
- Is the level of nitrogen dioxide high in front of our school compared to other schools in Gozo?
- What are the causes of such level of nitrogen?
- What can be done to reduce the level of nitrogen dioxide and improve air quality especially in urban areas?

Research Methods

During this campaign, different data was collected from the same location in front of the Three Hills fountain. A diffusion tube which was donated by Europe Direct Gozo, was attached to a pole in front of the institute to measure nitrogen dioxide levels in the surrounding air. Date and time when it was set up and removed were recorded. The tube together with other tubes of other Gozitan schools were analysed in a laboratory. The data gathered from the tubes is presented in Figure 11. It is evident that the area in front of our institute is the most polluted.

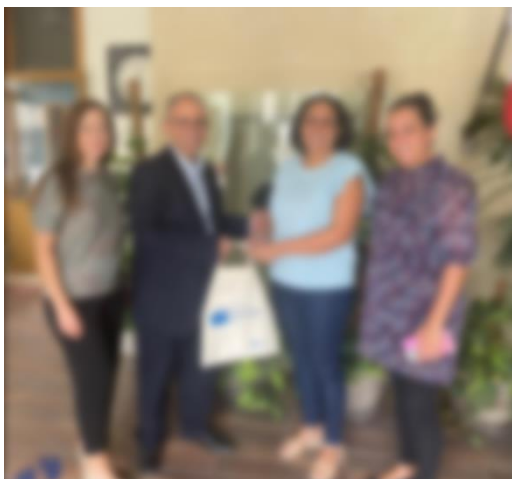**Figure 1**: Location from where data was collected.

Figure 2

Figure 3

Figure 2: Presentation of kit by GLOBE Malta and Europe Direct Gozo representatives.

Figure 3: Putting up the diffusion tube in front of the institute.

During the same period, observation of the weather was also carried out daily and in most cases around the same time, that is between 10 a.m. and noon. Cloud type, air temperature, pressure, humidity, rainfall, wind and visibility were observed as seen in Figure 4. During most days, the visibility was good or fair. There were some windy days, but no strong wind was recorded. These conditions did not seem to impact the traffic. The only weather factor that seemed to impact traffic from the data gathered, is rain. It was raining only on the last day, the 14th of November, where one could notice a decrease in traffic.

Date	Time	Cloud type			Air Temperature (°C)	Pressure (mb)	Humidity (%)	Rainfall		Wind			Visibility		
		High	Mid	Low				Yes	No	Strong	Light	Calm	Good	Fair	Poor
17/10/2022	11:00				23.5°	30.31	53%		✓		✓		✓		
18/10/2022	10:55				22.2°	30.33	69%		✓			✓	✓		
19/10/2022	11:00	✓			22.8°	30.15	67%		✓		✓			✓	
20/10/2022	11:30	✓			23.9°	30.13	59%		✓			✓	✓		
21/10/2022	11:45		✓		22.7°	30.22	70%		✓		✓			✓	
24/10/2022	11:13				23.9°	30.27	69%		✓			✓	✓		
25/10/2022	10:52				25°	30.19	73%		✓			✓	✓		
26/10/2022	10:53				24.4°	30.18	74%		✓			✓	✓		
27/10/2022	11:00				25°	30.28	65%		✓			✓	✓		
28/10/2022	10:45				23.3°	30.29	81%		✓		✓		✓		
31/10/2022															
1/11/2022															
2/11/2022															
3/11/2022	10:50		✓		23.3°	30.20	67%		✓			✓		✓	
4/11/2022	11:55		✓		24.4°	29.99	68%		✓		✓		✓		
7/11/2022	11:20				21.1°	30.15	64%		✓		✓		✓		
8/11/2022	10:45		✓		21.1°	30.19	67%		✓			✓	✓		
9/11/2022	11:11	✓			22.2°	30.17	69%		✓			✓		✓	
10/11/2022	11:15		✓		21.1°	30.19	72%		✓			✓		✓	
11/11/2022	11:30		✓		22.2°	30.32	71%		✓		✓		✓		
14/11/2022	11:25	✓			17.8°	30.19	95%	✓				✓			✓

Sir M.A. Refalo Sixth Form Victoria

Coordinates   Latitude 36.04405°   Longitude 14.24406°

The GLOBE® Program   Air Quality Campaign   Ms R. Mercieca GLOBE Deputy Coordinator

Figure 4: Weather parameters datasheet

Results

The screenshots below show data uploaded on GLOBE website during observation period between October and November 2022 (Figures 5, 6, 7, 8, 9 and 10). The students collected daily readings of air temperature, barometric pressure, and humidity following GLOBE protocols.
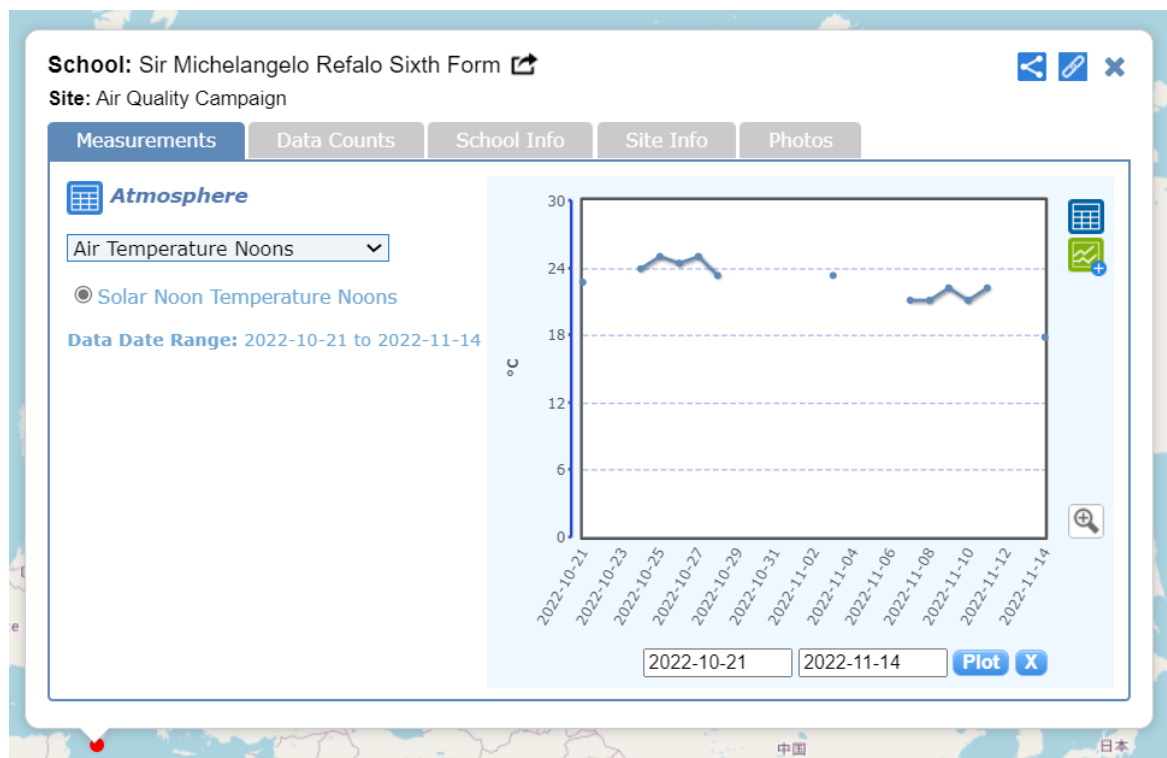
Air Temperature Noons

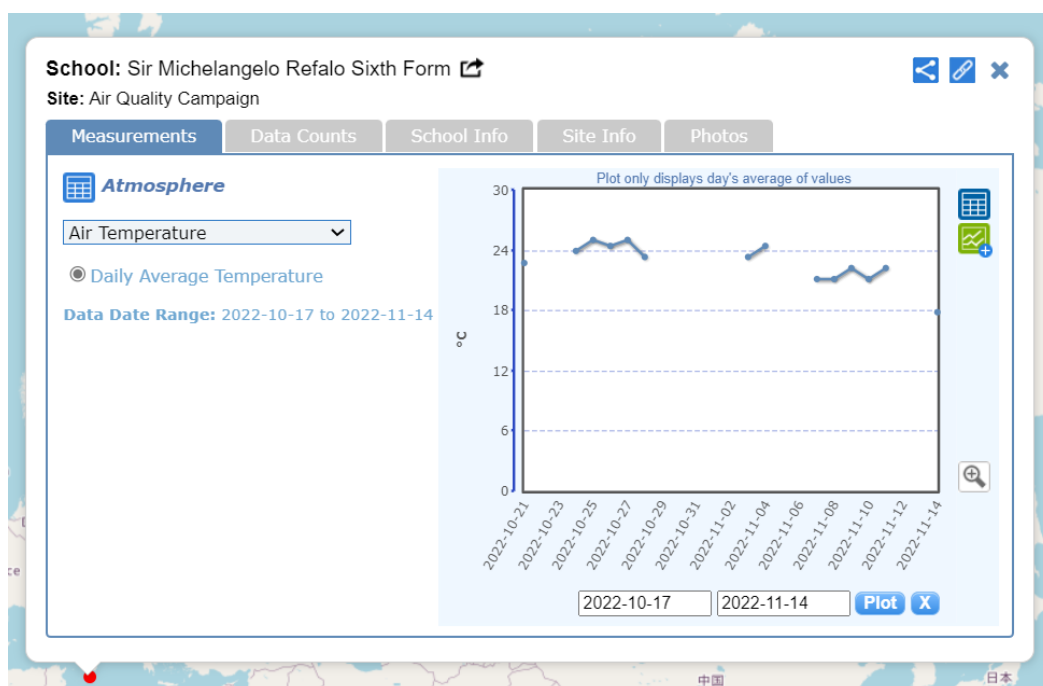**Figure 5:** Air Temperature Noons plot of VIZ GLOBE

Air Temperature

Figure 6: Air Temperature plot of VIZ GLOBE
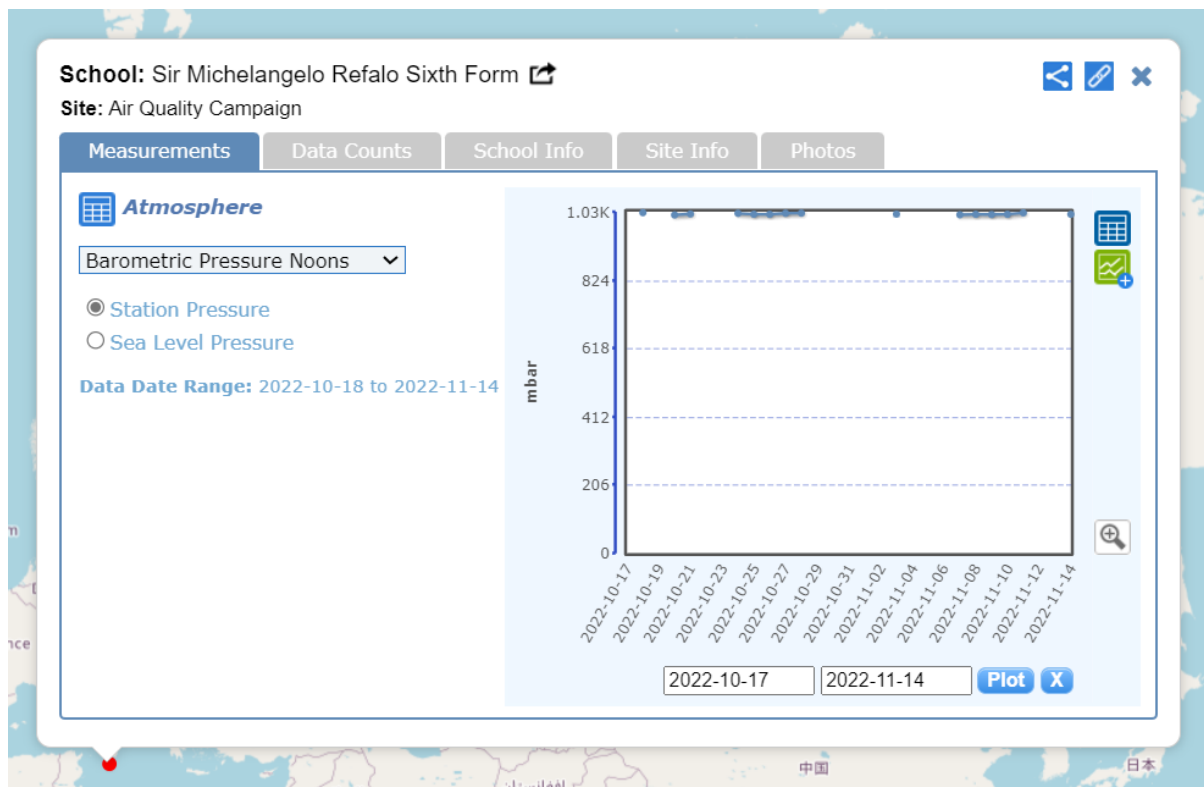
Barometric Pressure Noons

Figure 7: Barometric Pressure Noons plot of VIZ GLOBE
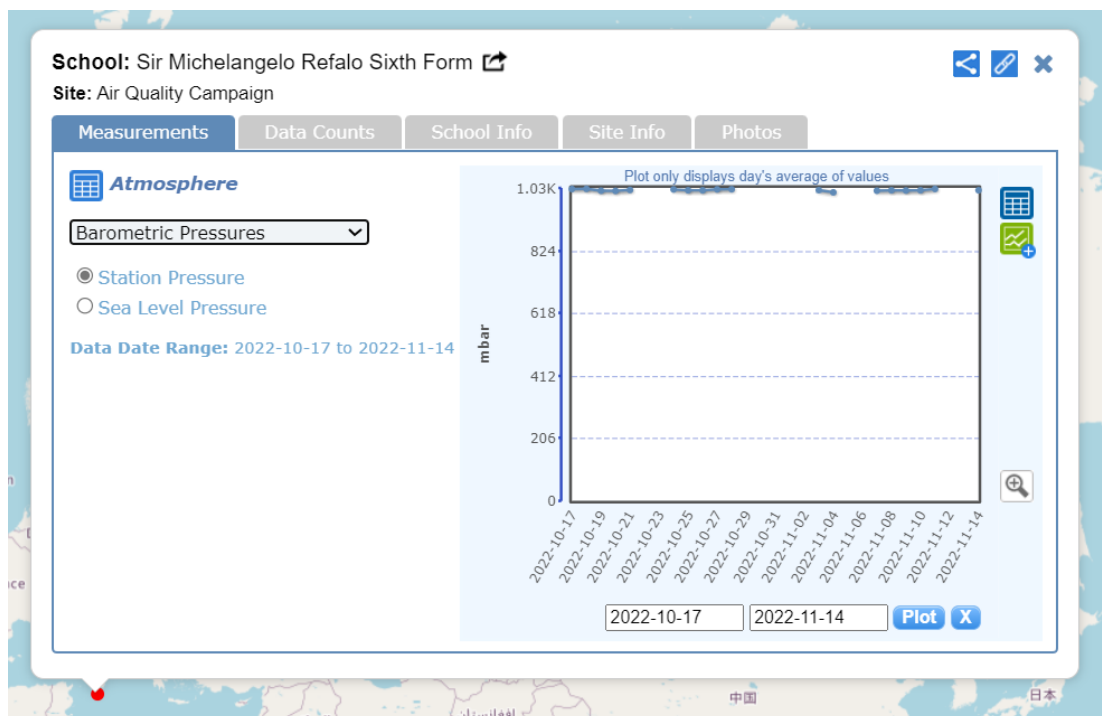
Barometric Pressure

Figure 8: Barometric Pressure plot of VIZ GLOBE

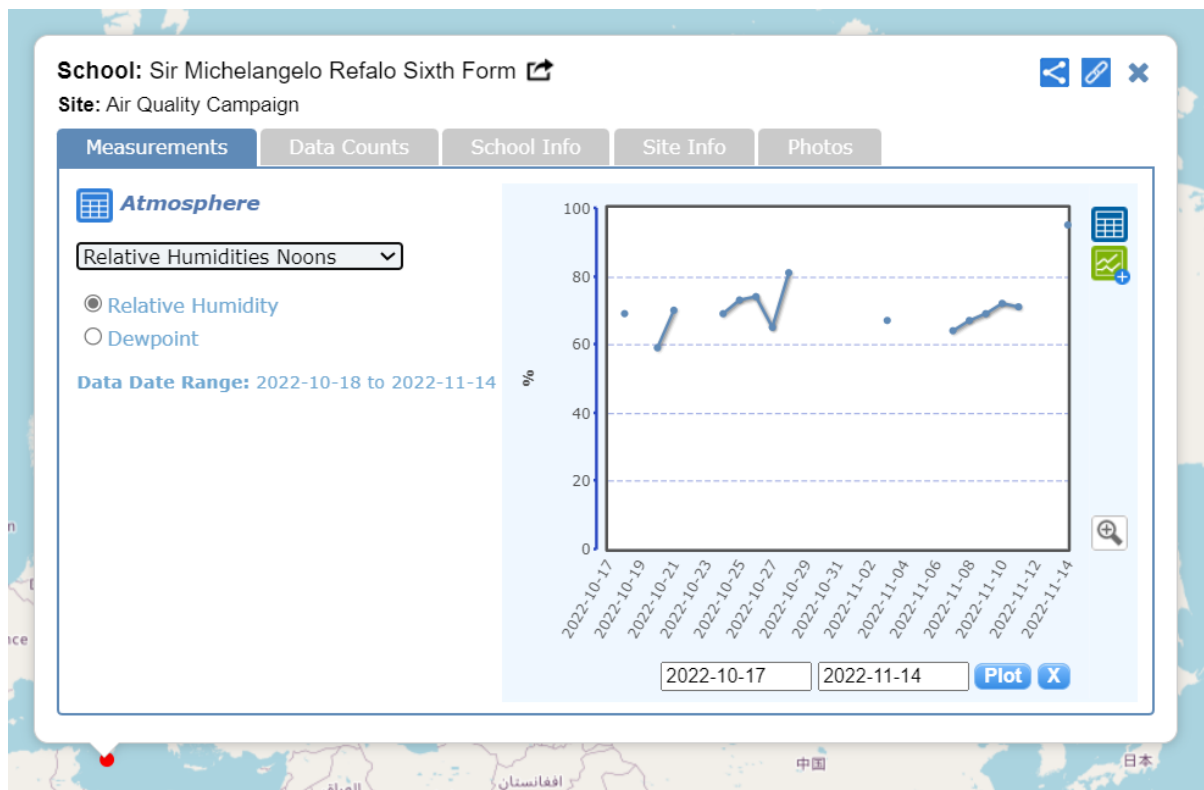## Relative Humidity Noons

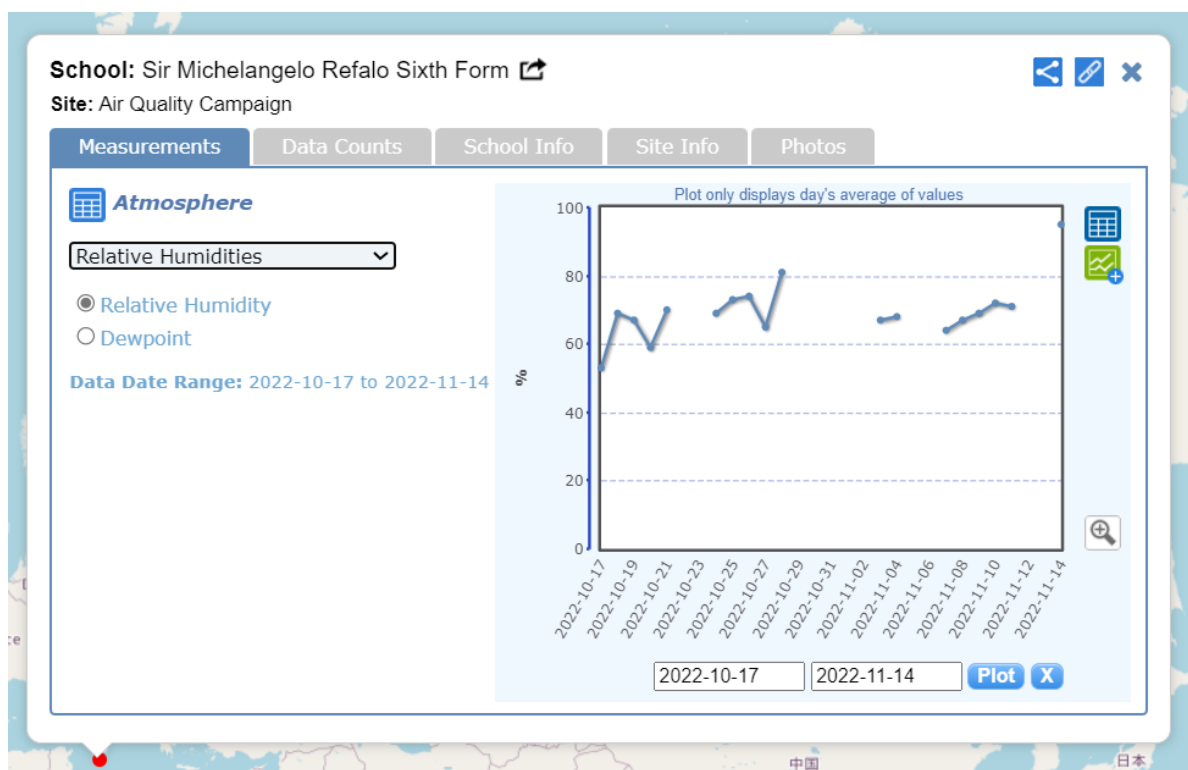**Figure 9:** Relative Humidity Noons plot of VIZ GLOBE

Relative Humidity

Figure 10: Relative Humidities plot of VIZ GLOBE

LABORATORY ANALYSIS REPORT
NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER	Q09327R
BOOKING IN REFERENCE	Q09327
DESPATCH NOTE	97363
CUSTOMER	Ramona Mercieca - GLOBE Malta Attn: Ramona Mercieca
	Palm Vale Apt 4
	Rabat Road
	Xlendi XLN 1103
	Gozo
	Malta
DATE SAMPLES RECEIVED	16/11/2022

Location	Sample Number	Date On*	Date Off*	Time* (hr.)	$\mu g/m^3$ *	ppb *	$\mu g\ NO_2$ on tube
Gozo College Middle School, Europe Street, Victoria, Gozo	2096424	17/10/2022	14/11/2022	671.87	30.70	16.02	1.50
St. Francis Primary School, Main Gate Street, Victoria, Gozo	2096425	17/10/2022	14/11/2022	672.00	36.90	19.26	1.80
Gozo College Rabat Primary School, Triq Vajringa, Victoria, Gozo	2096426	17/10/2022	14/11/2022	668.88	39.62	20.68	1.93
Gozo College Xewkija Primary School, Triq Tal-Hamrija, Xewkija	2096427	17/10/2022	14/11/2022	671.83	3.79	1.98	0.19
Gozo College Sannat Special Unit School, Sannat Road, Sannat	2096428	17/10/2022	14/11/2022	672.00	20.74	10.83	1.01
Gozo College Zebbug Primary School, St. Andrew Street, Zebbug	2096429	17/10/2022	14/11/2022	669.58	6.53	3.41	0.32
Sir M.A. Refalo Sixth Form, Fortunato Mizzi Street, Victoria	2096430	17/10/2022	14/11/2022	672.25	43.10	22.50	2.11
Sacred Heart Minor Seminary, Enrico Mizzi Street, Victoria	2096431	14/10/2022	14/11/2022	739.17	33.56	17.52	1.80
Laura Vicuna Primary School, Ghasri Square, Ghasri	2096432	17/10/2022	14/11/2022	671.80	5.61	2.93	0.27
Gozo College Qala Primary School, Triq it-Tempju, Qala	2096433	17/10/2022	14/11/2022	671.75	28.82	15.04	1.41
Gozo College Gharb Primary School, Triq il-Vizitazzjoni, Gharb	2096434	17/10/2022	14/11/2022	672.50	9.96	5.20	0.49
Laboratory Blank				739.17	0.09	0.05	0.005

Figure 11: Laboratory report

The amount of traffic was also recorded during the same period between 10:30a.m. and 11:30am from in front of the institute where the tube was attached. Traffic data was collected every day for approximately 10mins. While taking record, the traffic was ongoing especially that heading towards the city centre which at times also created traffic jams which hindered data collection. During most of the days, cars were the most frequent type of vehicle on the road followed by small vans and pickups. Few bicycles and buses passed by, the latter being mostly private buses. Fig. 13 shows a graph related to the data collected.

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9
Bicycle	0	0	1	4	2	1	0	1	0
Motorcycle	23	10	22	17	28	24	15	18	16
Car	113	112	114	126	124	105	122	93	108
Van/pick-up	38	27	37	35	48	29	21	16	33
small lorry	5	9	13	8	6	8	14	14	9
Articulated lorry	0	0	0	0	0	0	0	2	0
Bus/Coach	1	2	2	3	1	4	5	2	4
Construction Vehicle	6	5	2	5	4	5	4	6	6
Farm vehicle	0	0	0	0	0	0	0	0	0
	Day 10	**Day 11**	**Day 12**	**Day 13**	**Day 14**	**Day 15**	**Day 16**	**Day 17**	**Day 18**
Bicycle	0	0	0	3	3	1	1	0	0
Motorcycle	20	13	22	22	23	14	46	11	2
Car	86	110	121	114	97	102	161	83	68
Van/pick-up	14	36	25	60	26	20	63	19	26
small lorry	11	12	7	14	11	15	13	12	5
Articulated lorry	0	1	0	3	3	5	1	0	0
Bus/Coach	4	2	2	2	3	4	3	2	2
Construction Vehicle	5	3	1	7	4	5	5	4	0
Farm vehicle	0	1	0	0	0	0	0	1	0

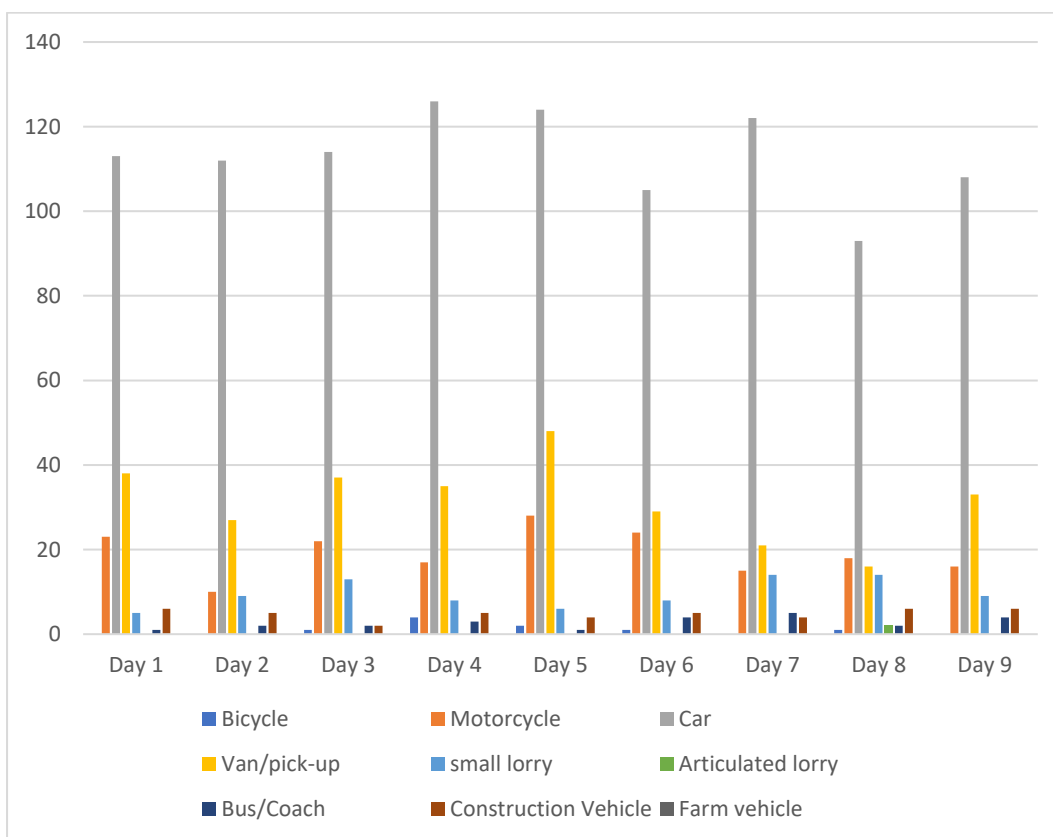**Figure 12:** Traffic data collected during the study.

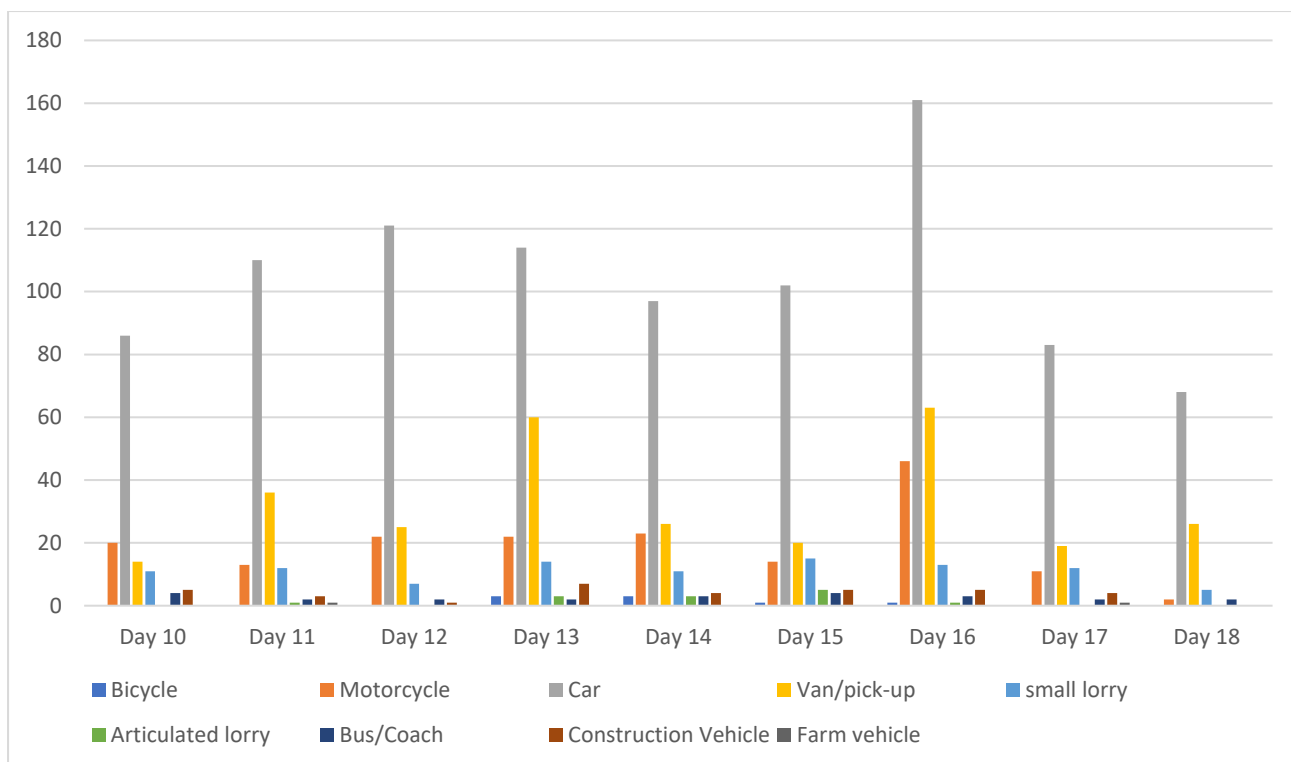**Figure 13:** Graph of traffic during the first 9 days of the study.

Figure 14: Graph of traffic during the last 8 days of the study.

Conclusion

From this study one could conclude that air pollution is a problem in Gozo's main city, Victoria, especially in the area where data was collected, the main contributor being traffic, which is becoming a national problem. Private cars on the Maltese islands are always on the increase. According to statistics, it is estimated that a total of 32 new vehicles were added to Malta's streets each day during the year 2022. More awareness is needed so that more people start using other modes of transportation.

The issue of transportation was tackled at the beginning of 2022 at our Institute by the Eco Skola team. A short online survey was carried out among 6th form students attending our Institute. In all, 134 students participated. As anticipated, many participants commute to school by private cars. There was also a considerable number who used public transport. Only few students carpooled, came on foot or cycled. Students were also asked to give a reason why they frequently used the indicated mode of transport. Several students argued that they do so because it is comfortable, convenient and easy to use. Others mentioned that it is cheap and environment friendly whilst a few students argued that they do so because there is no

other choice. When asked whether they take into consideration sustainable transportation, the majority, 62.7% responded yes, 29.1% responded maybe and 11 students answered that they do not take into consideration sustainable transportation. In this questionnaire students were also given the opportunity to suggest how the Institute could be more eco-friendly. Suggestions included those related to transportation, including the promoting of carpooling and public transport, organising transport to places where public transport is not convenient and making changes to the bus timetable.

References:

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(Accessed February 2023).

https://timesofmalta.com/article/air-pollution-eight-streets-eu-limit.968323

https://www.google.com/maps/place/26VV%2BJQG,+Victoria/@36.0433281,14.2441687,17z/data=!4m6!3m5!1s0x130fb4f74683eccd:0xdfc62fd7324eff62!8m2!3d36.0440949!4d14.22444769!16s%2Fg%2F11vkgks6zh?entry=ttu

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https://www.qld.gov.au/environment/pollution/monitoring/air/airpollution/pollutants/nitrogen-oxides (Accessed November 2022).

Badge description:

I am a Data Scientist: Students analysed their own data (from their measurements). They were able to analyse bar graphs to interpret the data. They also became aware of the limitations of the data and could only draw conclusions from the samples studied. From the data analysis, the students answered their research questions.

I make an Impact: Throughout the year students plant trees and plants around our school. This helps improving air quality, sequester carbon dioxide, shade and cool the surroundings, produce oxygen and improve human physical and mental health. It also helps support the student's development, learning and focus besides creating a more welcoming environment.

I am a Storyteller: The students shared all the stages of their investigation, from data collection to participation in webinars, and findings to conclusions, with the whole school community during morning assemblies and the GLOBE noticeboard. They also reached out to the wider community by uploading updates with photos on the school Facebook page and participated in a fair at Villa Rundle commemorating Europe Day. During the fair the student not only displayed their work but also participated in a panel discussion sharing their findings and putting forward solutions on how to improve the air quality.