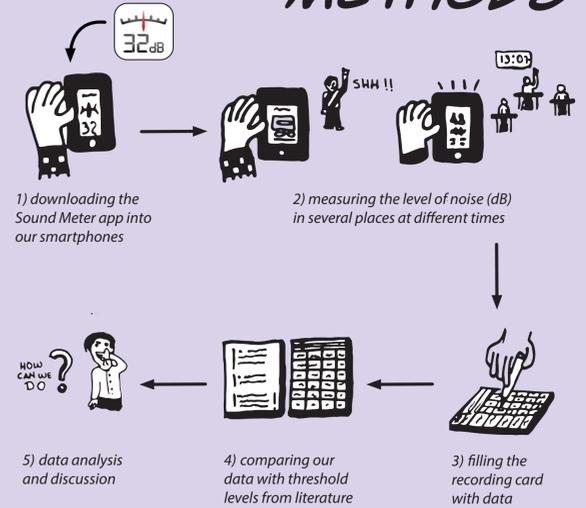




## INTRODUCTION

Noise pollution is considered to be any disturbing sound that affects human and animal health [1]. Long term exposure to noise pollution on humans can cause heart disease, high blood pressure as well as noise induced hearing loss (NIHL) [2]. Attention of students is also affected [3]. In the sea, the noise is mainly caused by ships and sonars that are harmful for toothed whales (i.e. dolphins, blue whales, etc...). These animals use echolocation (orientation by echo) for a variety of reasons, like navigating, finding food or mates. The damage of their hearing makes them confused or lost and it often ends up in strandings on beaches [1][4]. On land, other animals rely on echolocation, for example, bats. Sounds caused by human activities have been moreover shown to interfere with their life cycle [1][5]. Since noise level is such an important indicator of health and well-being (Fig. 1), we tried to measure the noise level in our school. To do it, we chose some areas: like the hallway, a classroom during a lesson, the gym, the entrance in Via dei Serragli. Then we downloaded the app Sound Meter on our phones (iOS; Android) and we used them as phonometers. We recorded the measures onto a recording card and then, basing on them, we tried to propose solutions that would help in mitigating the possible noise pollution.

## MATERIALS AND METHODS



## RESULTS AND DISCUSSION

To study noise levels in our school we considered several places and time of the day (see Table 1), for each measurement we recorded for 1 minute and we wrote in the table the average intensity of noise (in decibel, dB). Then we compared the values with the limits reported in literature [2][3] and in the tables provided by our CNR – BIOPROFILES partner. Basing on those thresholds we identified possible effects for human health.

Fortunately, the recorded sounds were below 85 dB, in fact, sounds that are above this intensity are very likely to cause hearing loss on long or repeated exposure. The noisiest conditions we measured, highlighted in yellow in Table 1, reach level 3, which means “negative impact on long-term exposure”. This is the lowest score we found for noisy places.

The main effects of noise pollution on human health are two:

- repeated exposure to noise can cause hearing loss by damaging the hair cells in the inner ear (Fig. 2),
- sound blasts can damage the eardrum or the ossicular chain [2]. There are also other effects like heart disease, high blood pressure, and stress [1].

Analysing our data, we realised that the main source of noise was voices, so we proposed some ways to reduce the intensity of sound:

1) Respect involves voice too. We must use our voice responsibly during the time we spend at school, especially during lessons, because if everyone speaks at the same time a lot of noise is generated. We must remember that the World Health Organization put a limit of 35 dB in classroom to allow good teaching and learning conditions.

2) Less crowd less noise. During the mid-morning snack, it would be better to split the point of distribution in two. If there are two points, then voices will be more “diluted”.

3) Putting phono-absorbant materials inside the walls would help in controlling noise.

4) To avoid sound blasts due to the school bell, it should be replaced with a light that flashes in each classroom and in the hallway, to signal the beginning and the end of every lesson. The school bell should be kept for emergencies only.

Recording card: NOISE POLLUTION					
Class		III A			
School		Pio x Artigianelli			
City		Florence			
Date and time	Location	Outdoor / Indoor	Noise source	Measured noise value in dB	Effect on human health
27/11/19 09:19	Entrance of school/courtyard	Outdoor	Building site	53	3
27/11/19 09:25	Gym during lesson	Indoor	Voices	46	3
27/11/19 09:21	Hallway during lessons	Indoor	Voices	22	1
27/11/19 09:25	Class during lesson	Indoor	Voices	39	2
27/11/19 09:30	Professors' room	Indoor	Background noises	23	1
27/11/19 10:00	Secretary desk during the ringing of the bell	Indoor	School bell noise	57	3
2/12/19 14:30	Canteen	Indoor	Voices	60	3
2/12/19 14:30	Canteen	Indoor	Voices	56	3
3/12/19 11:23	Class at lesson change	Indoor	Voices	59	3
3/12/19 11:25	Class during group activity	Indoor	Voices	51	3
4/12/19 10:50	Hallway during the mid-morning break	Indoor	Voices	54	3
4/12/19 10:50	Canteen during the mid-morning break	Indoor	Voices	59	3



Table 1  
**SCAN ME!**  
SOMEONE IS MEASURING NOISE

Figure 1  
levels of noise in daily activities

Figure 2  
hair cells, inner ear

