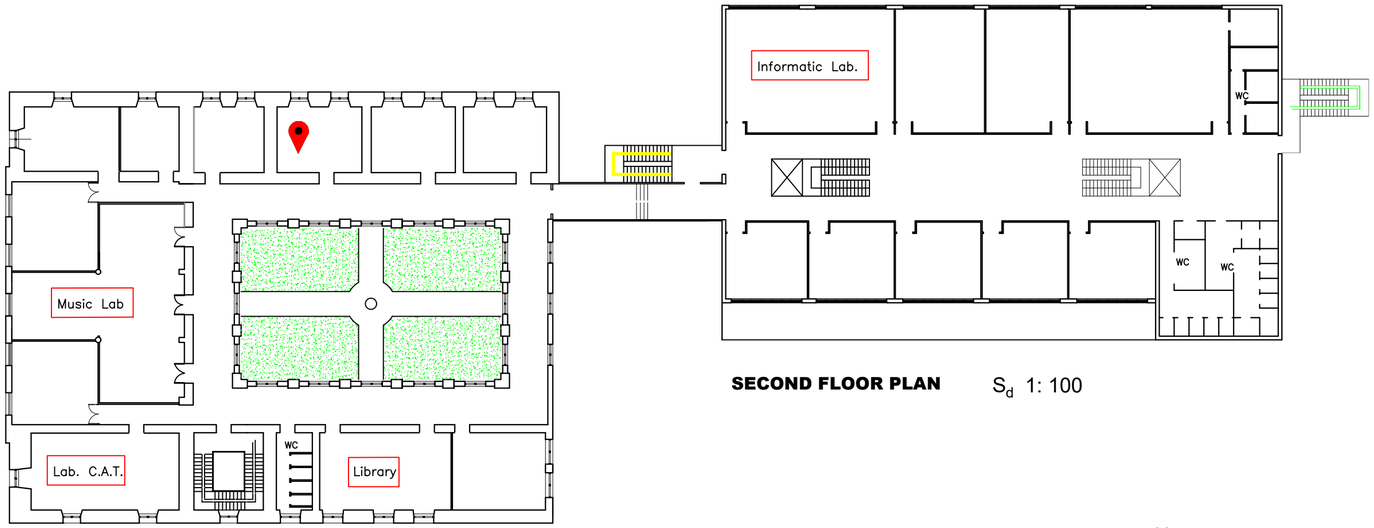
Air lighting of our class

Living in healthy environments, with adequate supplies of light and air, is essential for our well-being and for keeping buildings in good condition. To guarantee the quantity of natural lighting and ventilation, it is necessary to take into account the openings present with reference to the size of the room: the so-called air-lighting ratio comes into play here. As regards the air-lighting ratio in rooms intended for purposes other than residential, such as buildings public buildings, schools, shops, offices, industrial warehouses and spaces intended for production activities, it is necessary to refer to the local building regulations.
As regards the ventilation of habitable rooms and the use of school classrooms, the air-lighting ratio of 1/8 between the window surface and the walking surface is respected (for surfaces smaller than 100 m2). It is important to remember that designing offices for well-being working with the presence of natural light and good ventilation helps to make the environments more welcoming and improve the production level.
Let's now see how the air-lighting ratio is obtained, also considering a calculation example. It is important to remember that each Region or Municipality provides particular criteria for the glass surfaces eligible for the calculation, and it is therefore essential to check these regulations beforehand.



SECOND FLOOR PLAN S_d 1: 100

We wanted to verify the air-lighting relationship of our classroom by calculating the floor area through analytical geometry in particular, determining the sides of the classroom using the knowledge acquired in the study of the straight line.

$\overline{AB} = |x_B - x_A| = |6{,}10 \text{ m} - 0 \text{ m}| = 6{,}10 \text{m}$;
$\overline{BC} = |y_C - y_B| = |6{,}90 \text{ m} - 0 \text{ m}| = 6{,}90 \text{ m}$;
$\overline{CD} = |x_D - x_C| = |0 \text{ m} - 6{,}10 \text{ m}| = 6{,}10 \text{ m}$;
$\overline{DE} = |y_E - y_D| = |5{,}94 \text{ m} - 6{,}90 \text{ m}| = 0{,}96 \text{ m}$;
$\overline{FE} = \sqrt{(x_E - x_F)^2 + (y_E - y_F)^2} = \sqrt{(0 \text{ m} + 0{,}65 \text{ m})^2 + (5{,}94\text{m} - 5{,}74\text{m})^2} = \sqrt{0{,}46\text{m}^2} = 0{,}67 \text{ m}$;
$\overline{FG} = |y_G - y_F| = |4{,}36 \text{ m} - 5{,}74 \text{ m}| = 1{,}36 \text{ m}$;
$\overline{GH} = \sqrt{(x_H - x_G)^2 + (y_H - y_G)^2} = \sqrt{(0 \text{ m} + 0{,}65 \text{ m})^2 + (4{,}16 \text{ m} - 4{,}37)^2} = \sqrt{0{,}46\text{m}^2} = 0{,}67 \text{ m}$;
$\overline{HI} = |y_I - y_H| = |2{,}72 \text{ m} - 4{,}16 \text{ m}| = 1{,}44 \text{ m}$;
$\overline{LI} = \sqrt{(x_I - x_L)^2 + (y_I - y_L)^2} = \sqrt{(0 \text{ m} + 0{,}65 \text{ m})^2 + (2{,}72\text{m} - 2{,}51)^2} = \sqrt{0{,}46\text{m}^2} = 0{,}67 \text{ m}$;
$\overline{LM} = |y_M - y_L| = |1{,}11 \text{ m} - 2{,}51 \text{ m}| = 1{,}40 \text{ m}$;
$\overline{MN} = \sqrt{(x_N - x_M)^2 + (y_N - y_M)^2} = \sqrt{(0 \text{ m} + 0{,}65 \text{ m})^2 + (0{,}90 \text{ m} - 1{,}11\text{m})^2} = \sqrt{0{,}46\text{m}^2} = 0{,}67\text{m}$;
$\overline{NA} = |y_A - y_N| = |0 \text{ m} - 0{,}90 \text{ m}| = 0{,}90 \text{ m}$;

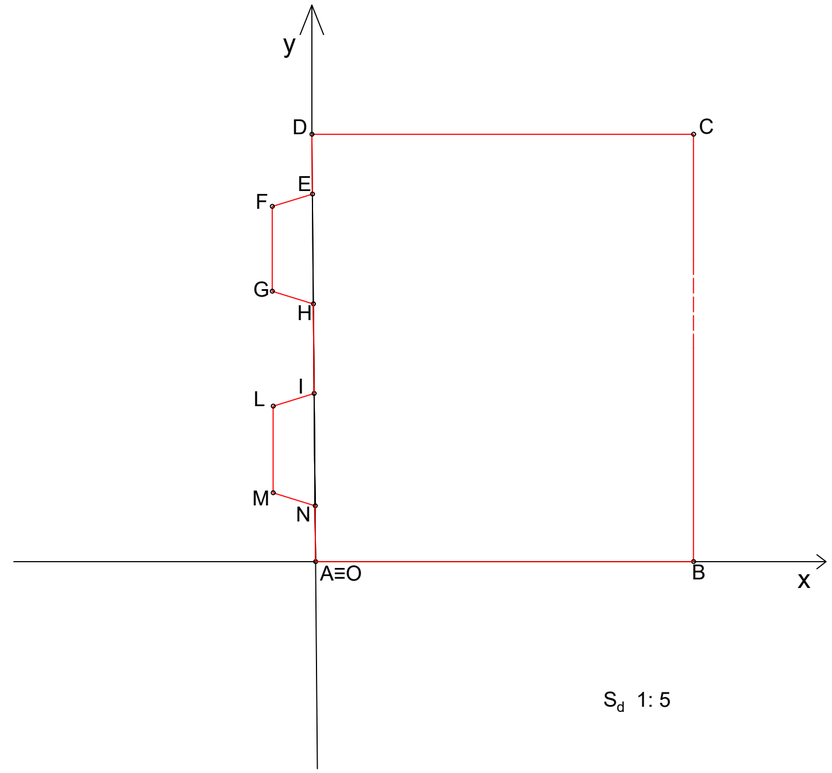
We calculate the area and perimeter of the room by dividing the room into several geometric figures.
The total area that we will get will be the floor area of the room, which we will use when calculating the R.I. .

$2p = \overline{AB} + \overline{BC} + \overline{CD} + \overline{DE} + \overline{FE} + \overline{FG} + \overline{GH} + \overline{HI} + \overline{LI} + \overline{LM} + \overline{MN} + \overline{NA} = 6{,}10 \text{ m} + 6{,}90 \text{ m} + 6{,}10 \text{ m} + 0{,}96 \text{ m} + 0{,}67 \text{ m} + 1{,}36 \text{ m} + 0{,}67 \text{ m} + 1{,}44 \text{ m} + 0{,}67 \text{ m} + 1{,}40 \text{ m} + 0{,}67 \text{ m} + 0{,}90 \text{ m} = 97{,}74 \text{ m}$;

$A_{EFGH} \equiv A_{ILMN}$ $\quad \overline{EH} \equiv \overline{FG} = |y_H - y_E| = |4{,}16 \text{ m} - 5{,}94 \text{ m}| = 1{,}78 \text{ m}$;

$$A_{EFGH} = \frac{\overline{EH} * \overline{FG}}{2} * X_F = \frac{1{,}78 \text{ m} * 1{,}36 \text{ m}}{2} * 0{,}65 \text{ m} = 1{,}02 \text{ m}^2;$$

$A_{ABCD} = \overline{AB} * \overline{BC} = 6{,}10 \text{ m} * 6{,}90 \text{ m} = 42{,}09 \text{ m}^2$;
$A_{TOT} = A_{ABCD} + (A_{EFGH} * 2) = 42{,}09 \text{ m}^2 + 2{,}04 \text{ m}^2 = 44{,}13 \text{ m}^2$;



Hp:
A≡O (0;0)
B (6,10;0)
C (6,10;6,90)
D (0;6,90)
E (0;5,94)
F (-0,65;5,74)
G (-0,65;4,36)
H (0;4,16)
I (0;2,72)
L (-0,65;2,51)
M (0,65;1,11)
N (0;0,90)

Th:
A = ?
2p = ?

S_d 1: 5

The general formula involves the division between the sum of the useful window surfaces and the floor surface. We always refer to a single room, as the R.I. it is calculated separately for each one.
Natural light and air exchange in environments are fundamental elements for people's health and comfort, and affect the well-being and quality of our lives. Spending time in places that are healthy and livable is essential.
The impact on consumption should also not be overlooked: reducing the use of artificial lighting and mechanical ventilation systems allows you to save energy, reducing costs and safeguarding the environment.
In our classroom as in all the classrooms of the IIS Carafa-Giustiniani, the air-illuminating relationship is satisfied. Maintaining the right exchange of air and light while maintaining environmental, social and economic sustainability.

$A_{TOT} \equiv S_{floor} = 44{,}13 \text{ m}^2$
$S_{window\ 1} = 3 \text{ m}^2$;
$S_{window\ 2} = 3 \text{ m}^2$;
$S_{window} = S_{window\ 1} + S_{window\ 2} = 6 \text{ m}^2$;

$$R.I. = \frac{S_{windows}}{S_{floor}} = \frac{6 \text{ m}^2}{44{,}13 \text{ m}^2} = 0{,}135 \geq 0{,}125$$

History and sustainability
the IIS Carafa Giustiniani as an example of excellence

Prof.ssa Pescatore Rosa (Maths)
4 CAT - a.s. 2023\2024