

# ITALIAN SECONDARY SCHOOL L.S. "MORE LIGHT, LESS LIGHTING"

STE(AM) 2<sup>ND</sup> CO-CREATION WORKSHOP - OCTOBER 2<sup>ND</sup> 2020

CARMELITA CIPOLLONE – TEAM LEAD TEACHER



## MORE LIGH, LESS LIGHTING – LS STAKEHOLDERS

Stakeholders Involved in the implementation of this LS:

- Lead Teacher: Carmelita Cipollone - Physics, Mathematics;
- STEM support teacher: Massimiliano Dirodi - Biology, Chemistry;
- Non STEM support teacher: Tiziana Pezzella - Art history, Art design;
- Students: 17 – 18 years old, attending their fourth year at Liceo Scientifico Corradino D'Ascanio, Montesilvano - Italy

## MORE LIGHT, LESS LIGHTING – LS TOPIC INFORMATION AND AIMS

- This Learning Scenario aims to make students aware of the benefits of teamwork required in different learning contexts and in the process of acquiring knowledge, competences, skills and experiences that must be applied in order to solve a real-life question.
- Through this LS students will examine the multiple applications and uses of light deepening specific and technique contents in all the involved subjects, then they will apply all those acquired knowledges and abilities in order to solve the posed problem.
- The interdisciplinary topic will be the mean through which teachers will set up their teaching activities, using PBL (Problem-posing and Problem-solving), Inquiry Based Science Education (IBSE), Content and Language Integrated Learning (CLIL), and blended-learning methodologies, in order to make students acquire some of the key citizenship skills of the 21st century.

# MORE LIGHT, LESS LIGHTING – LS CONTENTS INFORMATION

Table 1: contents information

subjects	prerequisites	Contents in the LS
Physics	light propagation; electric field flux	light intensity; differences between radiometric quantities and photometric ones related to light intensity
Mathematics	geometric properties of the sphere; trigonometric relationships and theorems	trigonometric properties in a sphere; solid angle; contestualization in Physics (luminous flux and illuminance)
Biology	tissues and skin	effects of light on human organisms and on skin; sunscreens
Chemistry	chemical kinetics	photosynthesis
Art History	scenographic use of light in Baroque art	relationship between light and architecture; real buildings and the contemporary architecture
Art Design	geometric projections	the theory of shadows in descriptive geometry; enhancing the volume of buildings in drawings.

# MORE LIGHT, LESS LIGHTING – REPRESENTATIVE ACTIVITIES AND TOOLS PROMOTE STUDENTS AUTONOMY AND AWARENESS

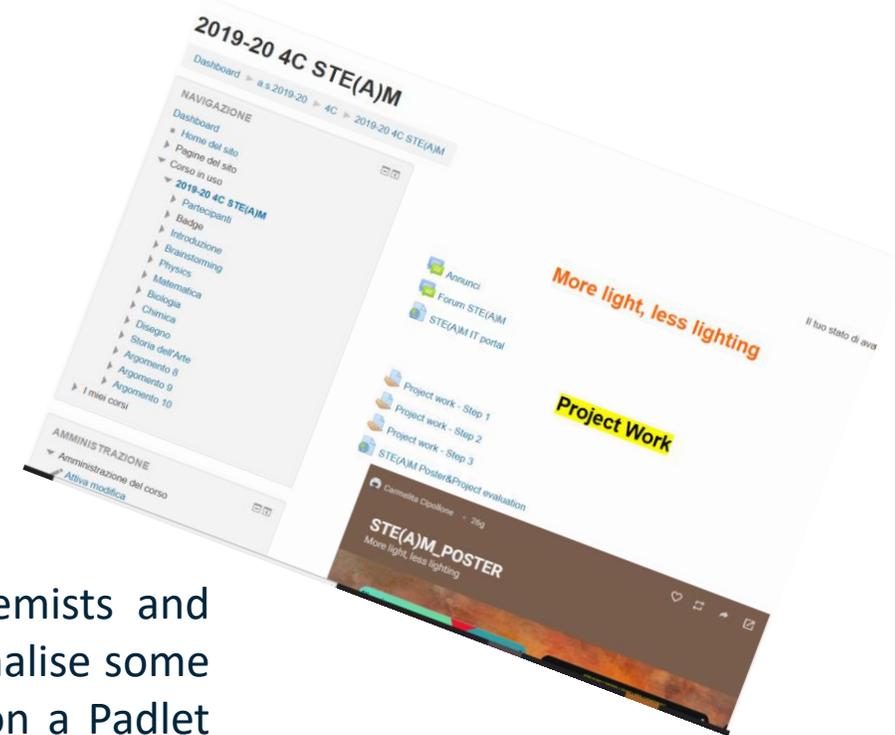
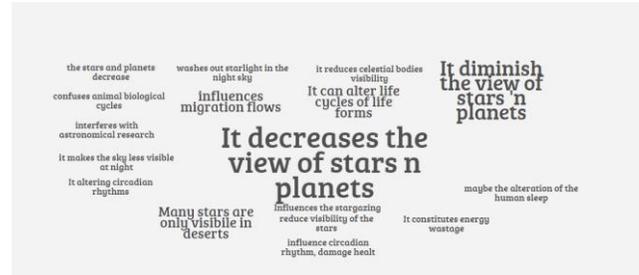
topic

connections

reasoning, reflection, observation

problems, difficulties and efforts

Teachers feedback



## brainstorming-flipped-jigsaw activity

firstly: starting question (<https://answergarden.ch/1220984>);

secondly: divide students in groups of experts (Physicists, Biologists, Chemists and Architects; i.e. 5 students per group); those experts groups were asked to analyse some online resources, to collaborate in building a document and to upload it on a Padlet ([https://padlet.com/carmelita\\_cipollone/mdy27pawgz9txec7](https://padlet.com/carmelita_cipollone/mdy27pawgz9txec7));

Thirdly: split the experts groups to form new mixed groups, in each group there are experts belonging to different expertise fields; students in those new groups shared their understandings;

finally: students individually participated in a Kahoot challenge.

# MORE LIGHT, LESS LIGHTING – REPRESENTATIVE ACTIVITIES AND TOOLS

## LIGHT INTENSITY VS FLUX ACTIVITY – GROUP STUDYING AND PEER EXPLAINING

....On some lamp package it is written the luminous flux (measured in lumens) whereas on some other the luminous intensity (expressed in candelas), **how can you compare the two lamp?**

..... **Complete the following table by consulting the following sources**

<http://hyperphysics.phy-astr.gsu.edu/hbase/vision/radphocon.html#c1>

<http://hyperphysics.phy-astr.gsu.edu/hbase/vision/photomcon.html#c1>

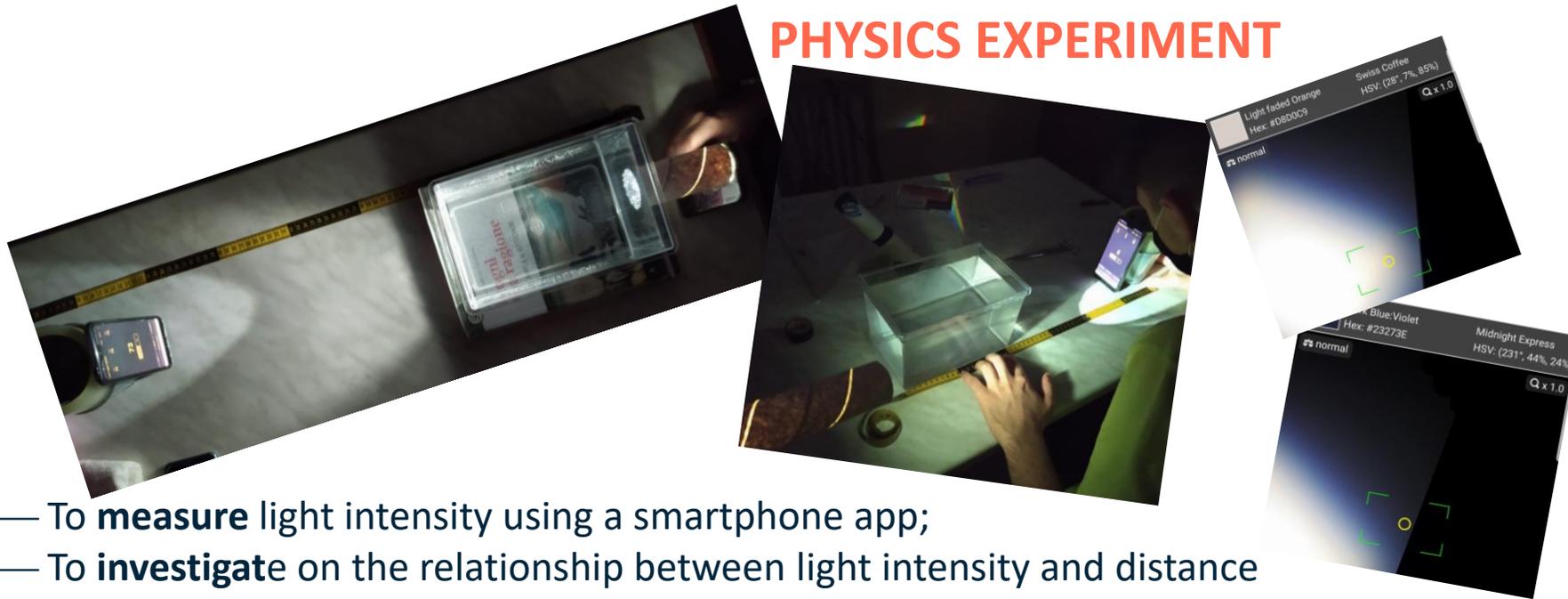
<http://hyperphysics.phy-astr.gsu.edu/hbase/vision/lumpow.html#c3>

-	Radiometric units	Photometric units
name of the physical quantity	Radiant power	Luminous flux
symbol		
units		
symbol of units		
What it measures		
name of the physical quantity	Radiant intensity	Luminous intensity
symbol		
units		
symbol of units		
What it measures		
name of the physical quantity	Irradiance	Illuminance
symbol		
units		
symbol of units	-	-
What it measures	-	-

<https://drive.google.com/drive/folders/19GHAt8S5dT5LvBvQybdF73m4TfcLmYE7>

# MORE LIGHT, LESS LIGHTING – REPRESENTATIVE ACTIVITIES AND TOOLS

## PHYSICS EXPERIMENT



- To **measure** light intensity using a smartphone app;
- To **investigate** on the relationship between light intensity and distance
- To **study the phenomenon** of light diffusion using a smartphone app (students used the Physics toolbox color-meter app) in order to **explain phenomena of daily life** such as the blue color of the sky and the orange-red color of the solar disk at sunset.

### Indeep questions, elaborating data

- Investigates on the law .....report your calculations .....process the experimental errors .....brightness is ..... proportional to.....
- Represents the collected experimental data in a graph. Are all the data in agreement with the relationship found? If there are discordant data try to give a reason.
- .....conclusion .....experimental evidences.....

Distance (m) ±0,01	Illuminance (lx) ±5
0,30	-
0,40	-
0,50	-
0,60	-
0,70	-
0,80	-

Table 3. Research of the proportionality between illuminance and distance

# MORE LIGH, LESS LIGHTING – REPRESENTATIVE ACTIVITIES AND TOOLS

## ARCHITECTURE AND LIGHT: MY CASE STUDY – PLANNING AND REALIZING

Theme	Synthesis
Lighting wellness in relation to the specific use	Use of the building: Lighting efficacy in relation to one of the following two items: a) activities that take place within architecture (natural light) b) enhancement of the monument (artificial light) .....
Originality in the management of light compared to solutions adopted in buildings similar in function or form	Comparative analysis of my case study with a building related to it: .....
Insertion of the architectural work in the context in which it is located	Elements of integration and / or originality with respect to the landscape-architectural heritage of reference: .....

## HELP A DANE! - PRODUCING A VIDEO THROUGH WHICH COMMUNICATE SCIENTIFIC CONTENT TO A WIDE PUBLIC

.....let's watch together this video .... Do you think the message thus conceived can arrive?

.... create a spot, lasting no more than 2 minutes  
..... Your spot, however, must necessarily contain some words, written or pronounced, between the following:

UVA and UVB, Melanin, Sunscreen, Protection factor, DNA, Skin

# MORE LIGH, LESS LIGHTING – LEARNING PRODUCTS

STUDENTS FEEDBACK

# MORE LIGHT, LESS LIGHTING - LEARNING PRODUCTS PADLETS, VIDEOS, GROUPS LEARNING PRODUCTS

### What would be needed to have light with less lighting?

briefly describe your project

- Di Giovannantonio Riccardo**  
First of all, cities should replace current outdoor lights with low-glare ones. If light isn't heading to the ground or isn't covered, it will uselessly illuminate the sky causing pollution. Lights whose blue beam is pointed skyward are the worst for sky glow, so they should be switched off or replaced with warmer lights. Individually we can use more warm-colored Led lights in our homes, limit the use of decorative lights or using automatic system to switch off outdoor lights at a certain time.
- D'Agostino Bonomi Alessio**  
I think we should first change the different types of fixtures that illuminate our streets. There are many types of fixtures that disperse a lot of light, so they must be replaced with the type called full-cutoff. This type has a flat protection that prevents light from scattering sideways and upwards. We should also change the different types of bulbs in these fixtures, so change the LED bulbs with sodium bulbs. Blue lights should be replaced with warm lights because the atmosphere diffuses more blue light than
- Triozzi Agnese**  
The main solution to reduce light pollution are:  
1-to replace white-blue lights with warmer ones and use LED instead of normal bulbs,  
2-to change outdoor lighting fixtures in others that minimize light trespass,  
3-to schedule the use of streets lights, signs and indoor lights, making the most from sunlight.  
I think, likewise for the other forms of pollution, the answer is to cooperate, the solutions themselves are not so difficult but if they're not implemented by everyone, they're useless.
- Perez Andrea**  
The practical solutions are:  
-using smart lighting systems  
-reducing light's usage  
In the first case the most used methods are the installation of LED lights or full-cutoff ones, which can direct light on a small angle (less than 180°), only where it's actually needed. And another thing we can do is to use eco-friendly and renewable energies to produce electricity. In the second case, instead, we have to start to use more natural light when possible and reduce the time we spend using the artificial one, and that's
- Ranalli Stefano**  
To be able to have light producing less pollution, you could start using simple precautions: 1) the light must have an intensity that allows illumination of the areas concerned but with as little intensity as possible; 2) ball lamps (e.g. outdoor lamps) should not be used, but lamps that allow light to be directed from top to bottom.
- Rapochchini Luca**  
To reduce the light pollution...

# MORE LIGHT, LESS LIGHTING - LEARNING PRODUCTS

## ART DESIGN-DRAWING SUMMARY TABLE -ARCHITECTURE AND LIGHT



Bazzucco.jpg



Bonsignori.jpg



Campanelli.jpeg



Capodicasa.jpg



Cipriani.jpg



D\_Agostino.jpg



Di Giovannantonio.jpg



Di Tecco.jpg



Franceschilli.jpg



Norscia.jpeg



Perez.jpg



Piccari.jpeg



Ranalli.jpeg

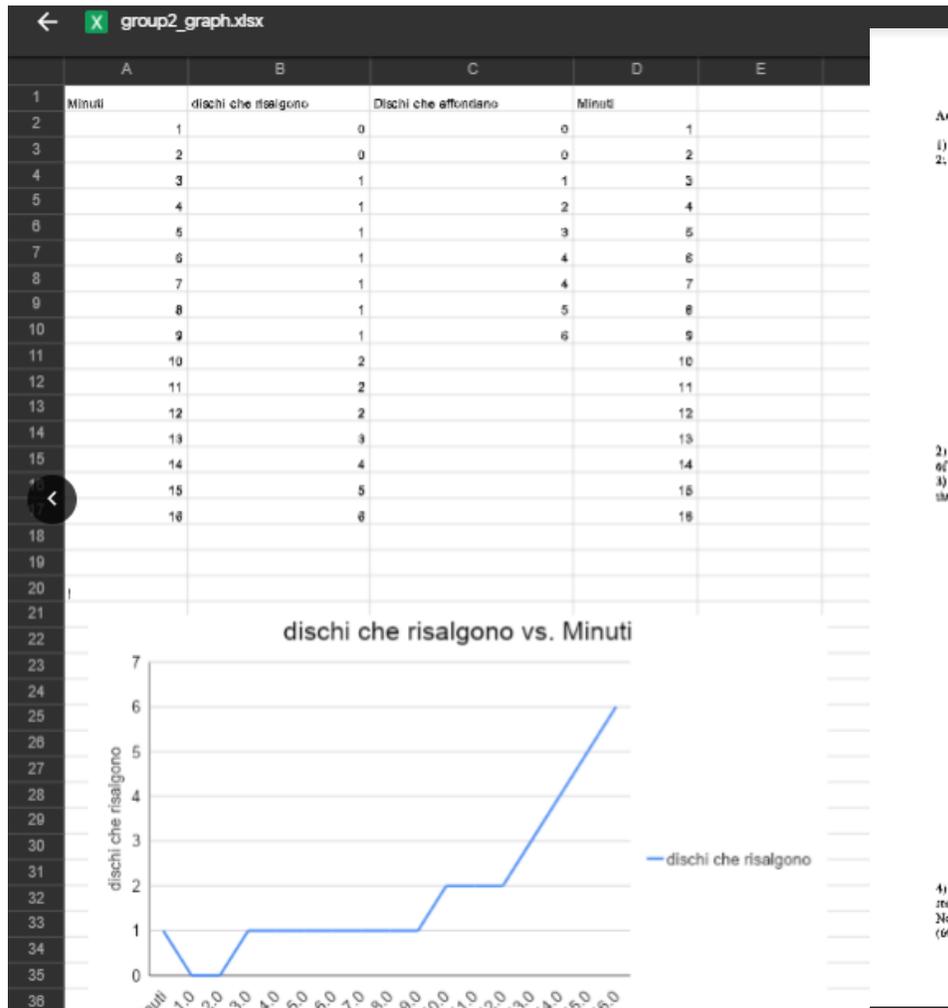


Rapacchiani.jpg



# MORE LIGHT, LESS LIGHTING - LEARNING PRODUCTS

## HOMEWORKS



### Annex P7 - Experiment indeep answers

- Investigate on the law that links illuminance to distance (step 1), report your calculations in Table 2, add any columns you need; process the experimental errors too.

Distance (m) ±0,01	Illuminance (lx) ±5	$E^2 d^2$ ( $lx^2 m^2$ )
0,40	5200	832
0,50	2795	60,25
0,60	1675	60
0,70	1150	565,5
0,80	780	499,2
0,90	510	421,2

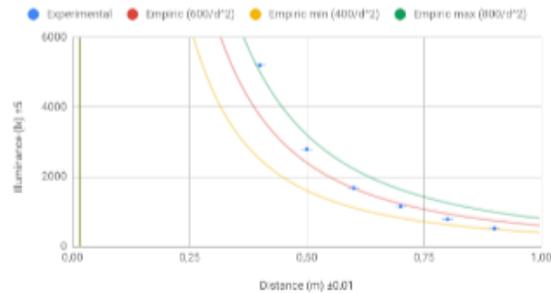
$$E^2 d^2_{avg} = (832 + 60,25 + 60 + 565,5 + 499,2 + 421,2) / 6 = 602,525$$

$$E_{avg} = \sqrt{602,525} = 24,546 \text{ lx} \approx 24,5 \text{ lx}$$

Table 2. Research of the proportionality between illuminance and distance.

- within the experimental uncertainties, the highest is ... inversely ... proportional ... to the square of the distance ...
- represent the collected experimental data in a graph, derive the theoretical law and represent it on the graph together with the experimental data. Being, as we said in point 2,  $E = k/d^2$ , and being  $E^2 d^2 = avg = 602 \text{ lx}^2 m^2$ , we have

#### Illuminance (lx) on Distance (m)



- Are all the data in agreement with the relationship found? If there are discordant data try to give a reason. No, all the data are totally in agreement with the empiric relationship when using the average value for  $k$  ( $600 \text{ lx}^2 m^2$ ) but all the data are between the maximum and minimum empiric values, that's because the

Progetto STE(A)M "More light, less lighting"

## CHIESA DEL GIUBILEO

Richard Meier

Martino Bazzucco 4°C Anno Scolastico 2019-20

**Informazioni generali sull'edificio**

- Architect:** Richard Meier
- Description:** Un edificio che vuole porsi come centro comunitario, ma anche come elemento simbolico molto forte: la candida chiesa richiama una nave con le vele spiegate al vento, pronta a salpare verso il nuovo millennio.
- Location:** Piazza Largo Terzo Millennio, Roma
- Year:** 2000-2003
- Concept:** Pensata per riunire lo spazio liturgico e quello parrocchiale.

**Gli Interni**

- E' dedicato ad Est ed a Ovest da due pareti sovrastate in calcinacci bianchi.
- Ad Est → Si crea un piccolo ingresso al buio, quest'area accoglie l'organo.
- Ad Ovest → quest'area è basata da un'apertura simbiotica, sostiene il crocifisso ligneo grazie ad una piccola nicchia.
- Allo spazio del presbitero un volume rettangolare accoglie la sagrestia.
- A Nord, un corridoio separa e al tempo stesso conduce agli spazi parrocchiali.



# MORE LIGHT, LESS LIGHTING - ITALIAN STUDENTS FEEDBACK

## **Describe at least one thing you didn't like much**

*The amount of work to be processed in a short time.*

*I would like to spend more time to work on this project because it was very interesting*

## **Describe at least one thing you did appreciate**

*I really liked creating the videos and the poster, also having collaborated with my group.*

*I really liked the topic of the work.*

*I enjoyed the Physics and the Chemistry experiments.*

*I enjoyed how we managed to collaborate and get a good job done.*

*I liked the participation of all members of my group.*

*I enjoyed working in a team, developing videos, drawings and ideas comparing myself with others, it was a moment of detachment from this period.*

## **What would you have liked to do?**

*Do some field experiences, to see in real situations how the light changes.*

## **According to you, what should/could teachers modify/add in order to make the experience more effective for students?**

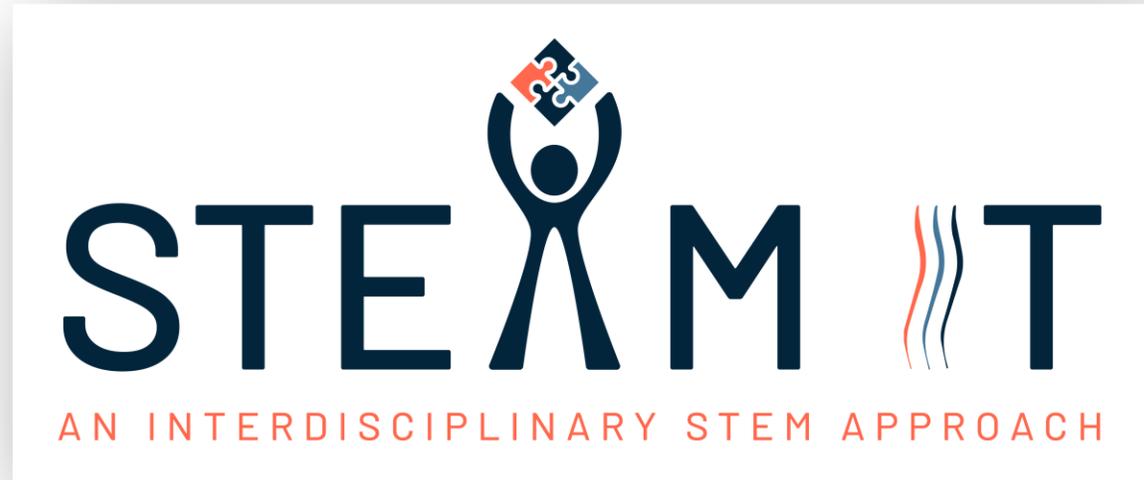
*Organize meetings with experts*

*A lesson with all the teachers would have helped, so that we could see all the various possible connections together*

# MORE LIGHT, LESS LIGHTING

Thank you

Enjoy testing !



**#STEAMIT\_project**