

“Warning!”

From physics to an interdisciplinary project to discuss
with students about the big planetary threats

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The context:

Pandemics (like COVID-19) are not the only sources of risk at planetary level.

- 20% of the Earth is permanently vulnerable to highly dangerous natural hazards
- more than 30% of European population lives in highly dangerous areas
- large geographic regions are exposed to multiple types of serious natural risks



- Earthquakes, volcanic eruptions, hurricanes, climatic changes and even asteroids can jeopardize our lives

The Idea:

To draw attention of new generations to natural events potentially threatening the whole mankind, Fondazione Pisa and Italian Institute for Nuclear Physics launched the initiative:

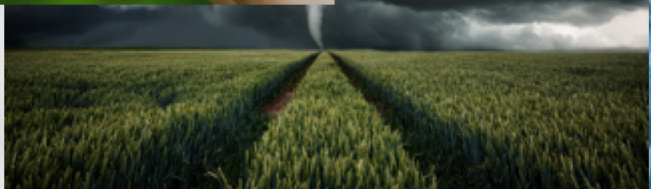
“Warning! The big planetary threats: knowing them to defend ourselves ”

which took place between December 2020 and May 2021

The project aimed at fostering a culture of «Being ready» thanks to the adoption of responsible and scientifically sound behaviors, addressing the limits of a culture dominated by the «here and now»

The project:

“Warning! The big planetary threats: knowing them to defend ourselves »
is a knowledge dissemination project which makes an effort to provide
interdisciplinary educational paths on the themes of environmental
fragility and dangerousness, addressing the general public at large,
but with a specific focus on young people



The Structure:

- The initiative was articulated in five events, each devoted to:
 - improve the scientific knowledge about different natural hazards
 - encourage precautionary and defensive behaviors

Main features:

- education on complexity
which requires
- Interdisciplinary approach &
 - cross knowledge



The five subjects:

→ Alarms from the atmosphere

→ Major biological hazards

→ The restless earth

Wonders and hidden →
dangers from space

Climate and oceans: sinister changes →



Why Physics?

Strategies peculiar to physics were the “fil rouge” accompanying the participants in this journey across many fields of science

- Interdisciplinarity promotes epistemological approaches
→ <<what can be known about it?>>
- and methodological insights
→ <<how can it be found out?>>

It is essential to review and compare <<future risks>> using a common set of metrics and to assess how the size and nature of risks are evolving (**not very different from what we do in our HEP experiments!**)

A common aspect of these phenomena is their complexity:

- the **unpredictability** of their development
 - the difficult **quantification of the risks**
 - the **interconnections** among them
- the increasingly **global nature** of their effects
- the **diversity of their impact** according to the social, economic and even cultural substrate in the various geographical areas

The **real world is made up of complex things** and its complexity is manifest in the incapacity of any formalism to capture all of its properties → **scientific method as primary tool to deal with complexity**

Moreover we are introducing <<scientific method>>....



Birth house of Galileo Galilei (G. Bettini, Comune di Pisa)



..... In the cradle of scientific method!!!!

The Partners

INFN is the Italian research agency dedicated to the study of the fundamental constituents of matter and the laws that govern them. INFN mission includes **the transfer of acquired knowledge to society**, intended as both technological transfer and **diffusion of the scientific culture to society, promoting dialogue with citizens**.

Fondazione Pisa has its origins from a banking foundation, and it's active on the territory in the fields of **cultural heritage, scientific research and philanthropy**



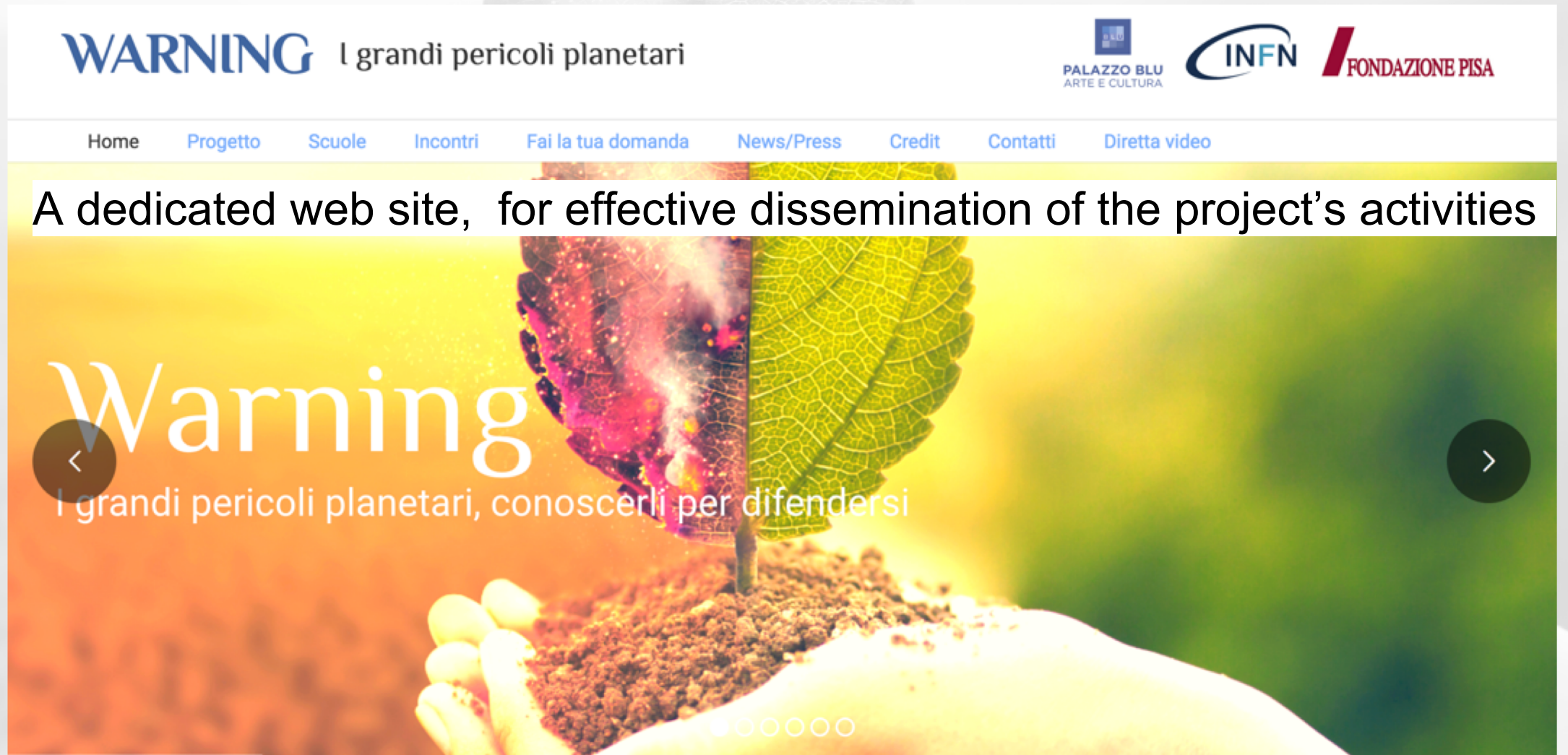
Palazzo Blu is the center of temporary exhibitions and cultural activities managed by Fondazione Pisa

<https://palazzoblu.it/>

The organization

- Due to the impending pandemic lockdown all events took place virtually
 - More than 3000 students from 25 High Schools participated, through mediation of their teachers
 - Explanatory material in digital form was made available before the debates
 - Students were asked to prepare and present their questions in advance
 - On average 600 questions were collected for each seminar → an accurate work of classification and selection was necessary
 - For each «seminar» the speakers were two scientists/researchers with complementary and interdisciplinary expertise
 - Each «seminar», being the «end-point» of a long path, lasted 2-3 hours
- **A significant part of the seminars was devoted to answering student questions**

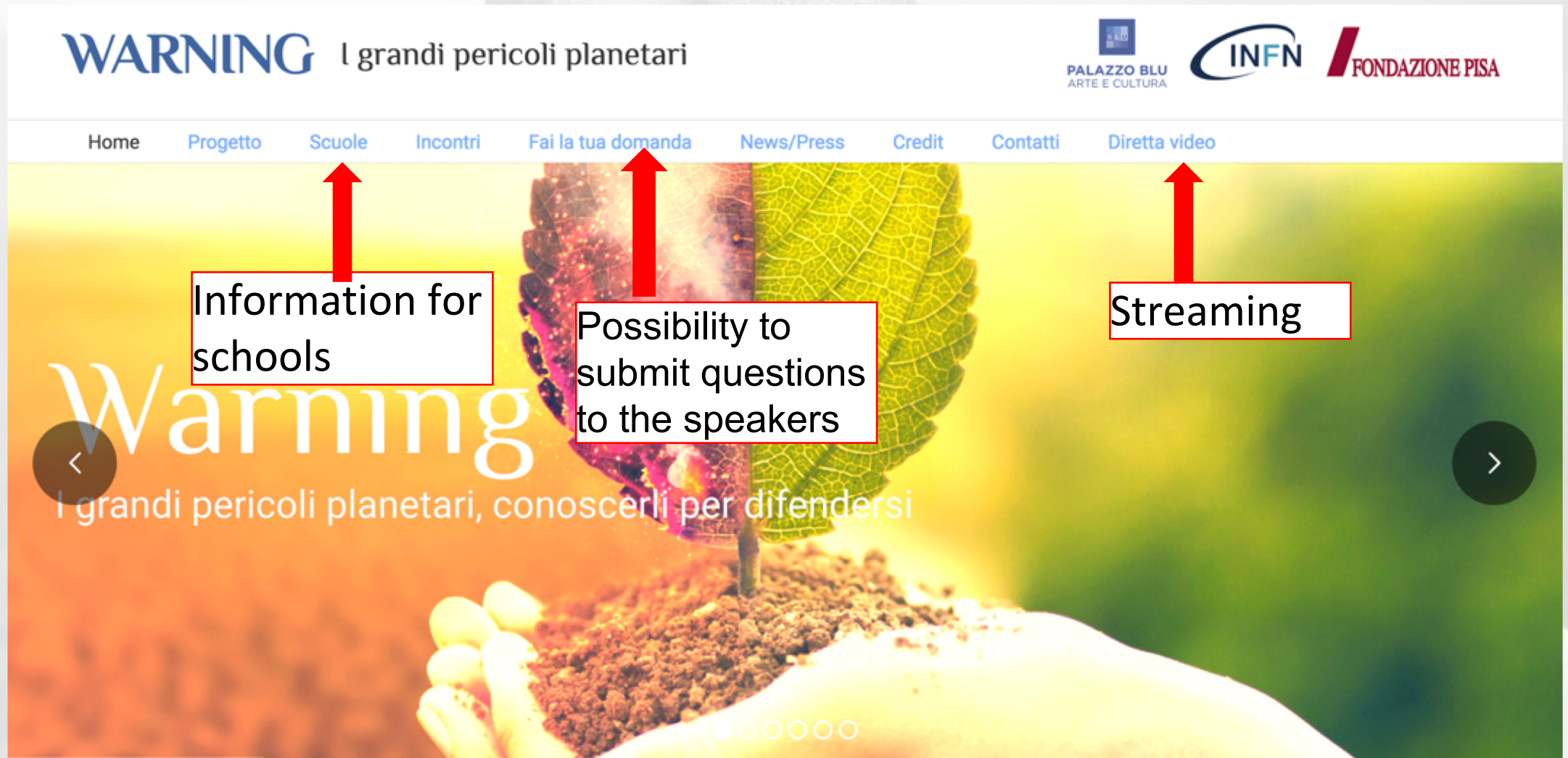
The Website: <https://warning.palazzoblu.it/>



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The Streaming

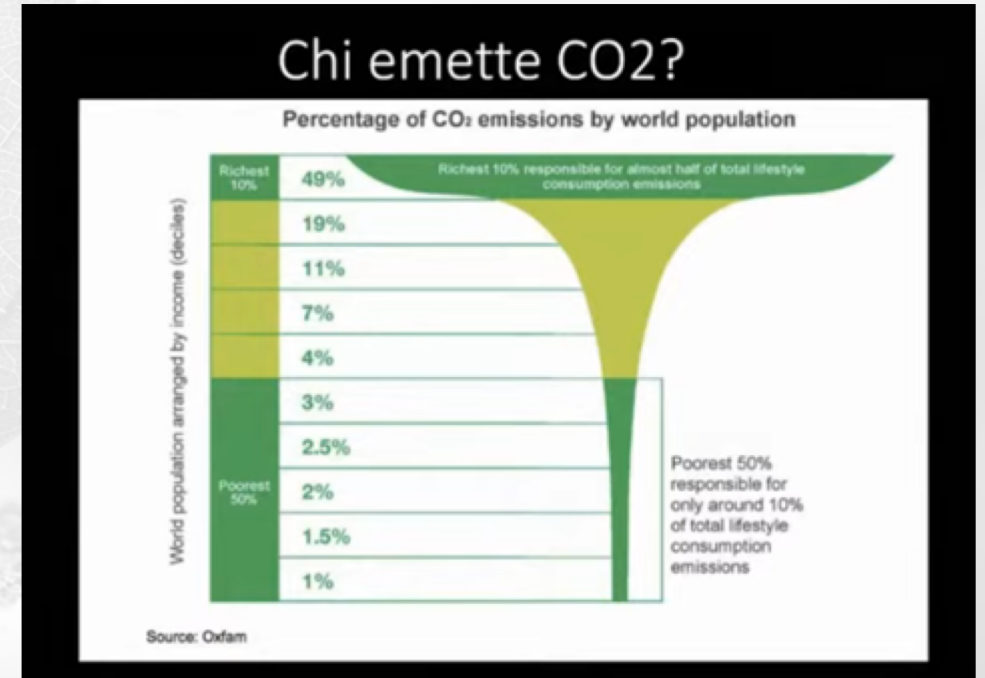
Each event was streamed online on «Warning» web site, on Palazzo Blu YouTube channel and on Palazzo Blu FaceBook page

The seminar's recording was made available from the Web site after the event.

On average each event was followed online by 700 registered participants and obtained offline from 3k to 9k visualizations

Just a glimpse at the five subjects:

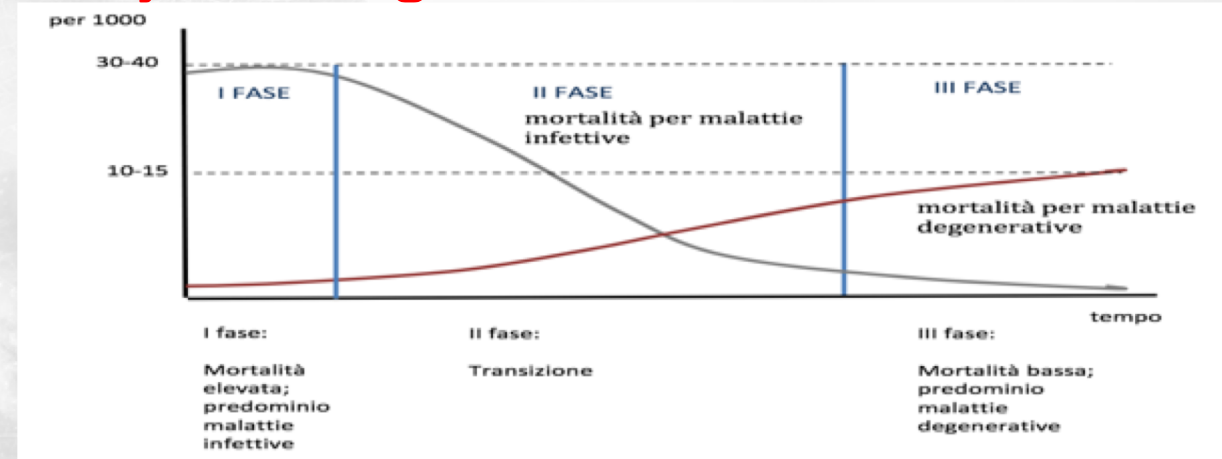
→ Alarms from the atmosphere



From the physics of the atmosphere, the economic consequences of the climate change, aspects related to the global warming and the increase of greenhouse gases were treated in the debate



→ Major biological hazards

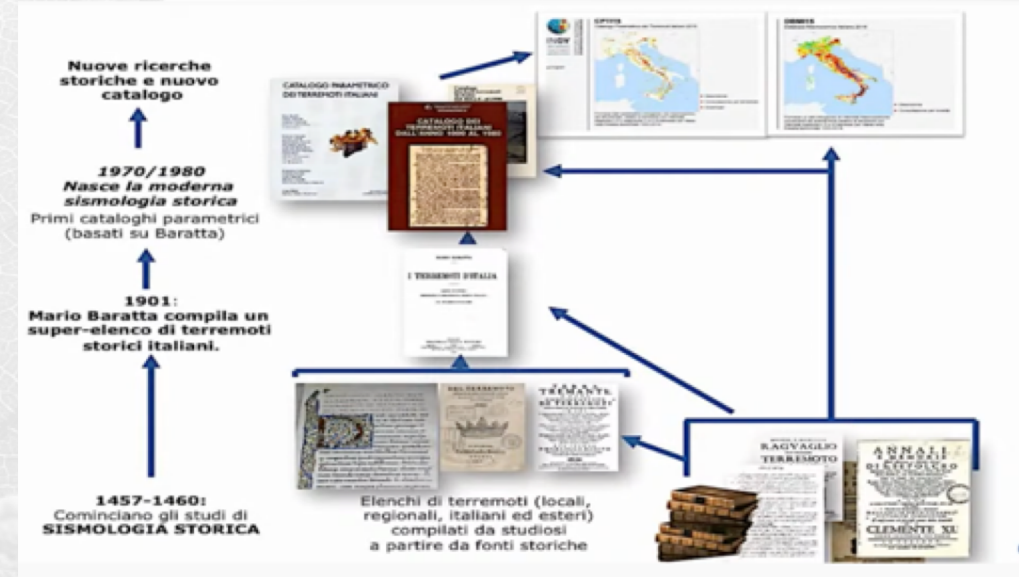


Not only COVID-19!! An overview of how pandemics changed the history of entire populations, and how the evolution of human habits influenced the spread of diseases was given.

During centuries, implementation of public health measures such as isolation, quarantine and border control helped to contain the spread of infectious diseases and maintain the structure of the society (not very different from what is happening today...)



→ The restless earth



From the study of the volcanic and seismic phenomena, to the issue of risk communication and the importance of vulnerability reduction actions. Geophysics gives us the tools to understand, but only an integrated analysis including history, physical geography, social sciences and economics provides a complete overview of volcanic-seismic hazards



→ Wonders and hidden dangers from space



We are becoming incredibly efficient at spotting Near-Earth Objects, but we still have no tested solution about comets or asteroids that might be on a collision path with the Earth.

In front of a NEO planetary risk, essential prerequisites to mitigation are the discovery of the NEO well in advance of possible impact and a planetary collaboration to look into the practical possibilities of countermeasures

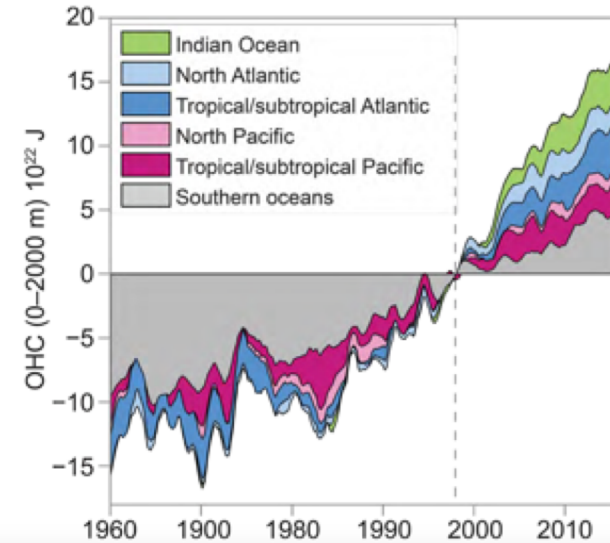
Warning I grandi pericoli planetari



→ Climate and oceans:
sinister changes

RISCALDAMENTO
DEGLI OCEANI

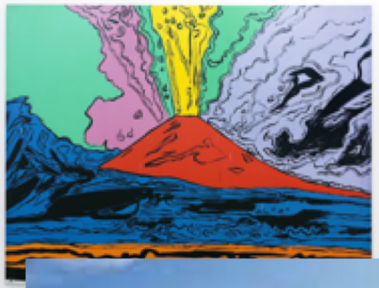
Ocean heat content changes from 1960
to 2015 for different ocean basins for 0
to 2,000 m depths
(Figure source: Cheng et al. 2017).



The ocean is being enormously affected by the increase of CO_2 from human activities: changes in water temperature, ocean acidification and deoxygenation lead to changes in oceanic circulation and chemistry, the rising of sea levels and increased storm intensity.

Weakened or even lost ecosystems increase human vulnerability and undermine the ability of countries to implement climate change adaptation and disaster risk reduction measures.

Andy Warhol e il "Vesuvio"



"Vesuvius" è tra le opere più iconiche realizzate negli anni Ottanta dall'artista americano **Andy Warhol** (Pittsburg 1928 - New York 1987) maestro della

Pop Art.

Il **Vesuvio**, reso con colori vivaci e traboccanti di energia, è colto durante una eruzione, "episodio nefasto ma anche foriero di rinnovamento e rigenerazione".

Pacific Trash Vortex

Approfondimento di un argomento contenuto nell'incontro «clima e oceani cambiamenti minacciosi»

Il «Big Bang»

Approfondimento di un argomento contenuto nell'incontro «Meraviglie e insidie dello spazio»

The Outcome

Many of the participating groups produced a final script in which they presented a personal elaboration on the various themes proposed during the project:

Some very interesting insights!

La peste nera

Approfondimento di un argomento contenuto nell'incontro «I grandi pericoli biologici»

Un secolo di pandemie

CLIMA E OCEANI:
CAMBIAMENTI
MINACCIOSI

«Il mondo è un bel posto e per esso vale la pena di lottare»

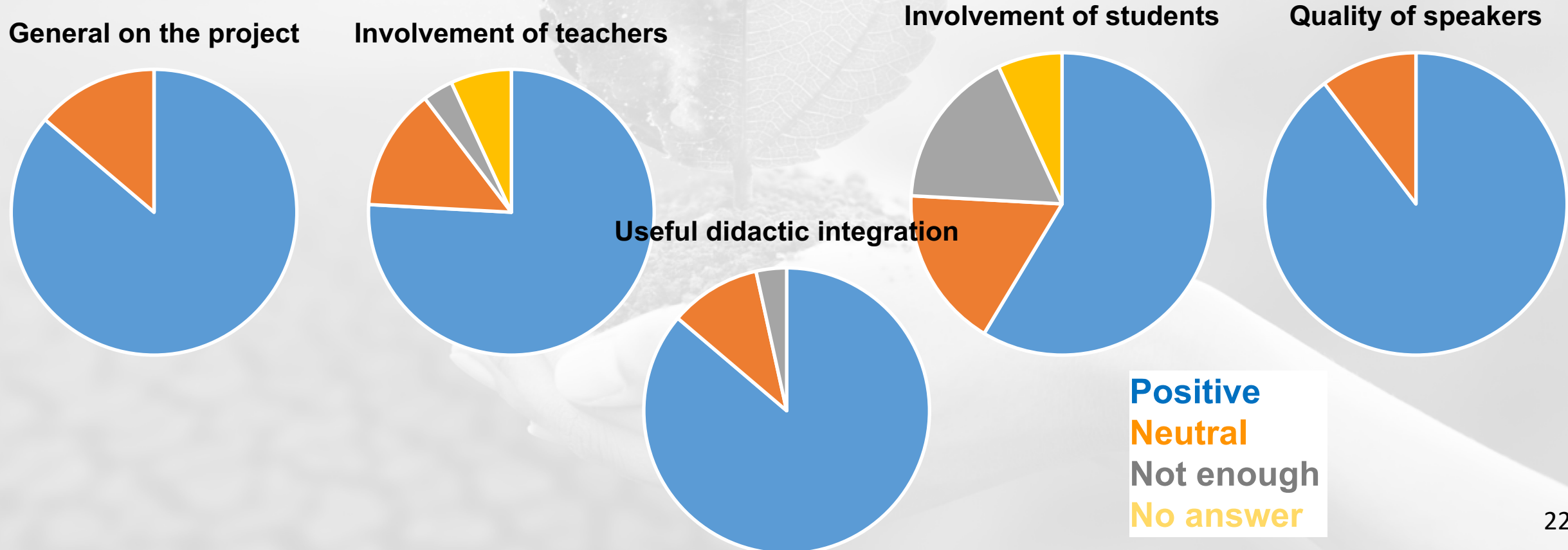
Ernest Hemingway

Classe III C Liceo Galilei - Firenze

MERAVIGLIE E INSIDIE
DALLO SPAZIO

The evaluation

A questionnaire was proposed to the teachers that coordinated the students' participation in the project to assess if the initiative met a positive response:



Conclusions

- Scientific method and multidisciplinary approach represent the best tools we have to face complex problems
 - <<Warning>> aimed to raise young people's awareness on the planetary hazards encouraging a scientific discussion about them
 - The positive response from participants exceeded out expectations
- We are looking forward to a second edition, in which we could learn more about the man-made risks that mankind can face in a near future

STAY TUNED

Acknowledgements

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Devitalia telecomunicazioni video shoot and recording