



PLANET
CHANGE

Space Hazards: Look up for NEO's

Teachers manual



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Planet change is the short name of an EU Erasmus+ project aimed at VET teachers and their students. With small activities, the idea is to create awareness about sustainability and acquire 21st century skills. All this is done in a technical context, mostly from space technology.

www.planetchange.eu



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1. General information

Duration: 2 sessions of 45 minutes each, in total.

Target group: 16-20 y.o.

European qualifications framework level: 1-4

Teacher preparation:

- study background information,
- watch full movie “Do not look up” (<https://www.netflix.com/es/title/81252357>)

Topic

Theme: space hazard

Keywords: sustainability, NEO, comet, meteorite, astronomy, planetary defense, extinction event

Activity

Goals

After this activity, students have a better understanding of the hazards that “Near Earth Objects” (NEO’s) pose to life on our planet, and the actions we can take up to minimize the risks, which include astronomical survey.

Summary

The objective of this activity is to understand the importance of space surveyance through astronomy, as a means to identify potential risks to the sustainability of life on Planet Earth derived from NEOs (Near Earth Objects).

Students will search individually and in groups for different online sources to explore what astronomers do at their jobs, they will gain basic knowledge of how meteorites and comets relate to the solar system, and how the scientific community reacts to the detection of NEOs (both potentially hazardous or not). Finally, they will propose ideas to improve the way we deal with NEO’s at the moment.



2. Introduction

Apart from the very well known Sun, planets and satellites of the Solar system, there are many other objects floating in space in our vicinity, and some have trajectories that might hit the earth sometime. These Near Earth Objects are monitored and tracked on a regular basis, and there are public data sources where we can see expected visits in the future.

The activity of astronomers with the most powerful telescopes is not normally oriented to survey the sky for new NEOs. However, discoveries happen thanks to the astronomical community reaching deeper and deeper into our surrounding Universe.

The event of a large meteor hitting the Earth and causing a major disaster is not at all unfeasible. In fact our Moon's surface, with all its craters on it, is a clear reminder that impacts occur. It is just a matter of time. We know of five extinction events here on Earth. Most of these are probably caused by a mixture of geological phenomena originated in our planet (i.e. massive volcanic eruptions blocking the atmosphere with dust) and by external agents (a NEO hit such as the one that scientist believe caused the Cretaceous–Paleogene extinction event). These events happen every couple of million years, and there might be nothing that we could do about them.

However (arguably to some), we are currently living (and causing) the sixth extinction. This so called Anthropogenic event, caused by human activity, is responsible for changes at a global scale (e.g., ozone layer, global warming, deforestation) and the disappearance of many species.

This video has a lot of useful information on the subject of NEOS:

<https://www.youtube.com/watch?v=h-eOIkWOekY&list=PLz0tdbacLdIFZcjPit7I3bA57GSVDYePU>

Description of the activity

Session 1: Watching the “Do not look up” movie introduction and developing first discussions (45 minutes)

→ Preparations: The classroom needs a screen or a projector to visualize the media content.

→ Activity 1 (15 min): Watch the “Do not look up” introduction online, without interruptions. Once finished, the teacher will ask the class to organize

- Groups of 3-4 students to discuss their opinion on the movie.
- On each group, one person will be selected amongst the members, as the group representative.

Then the groups will be assigned the task of internally promoting a discussion around the following guiding questions (20 minutes):

- What is your first impression on what you have seen?
- Do you think the scenes show situations (environments, people) that might be real?
- Have you ever visited an astronomy observatory?
- Do you think astronomy is useful?

After all groups have finished their internal discussions, their representatives will briefly expose the highlights of their group's opinions, in a summarized way (10min).



Session 2: Re - Watching the “Do not look up” movie introduction, with deeper insight (45 minutes)

→ Preparations: The classroom needs a screen or a projector to visualize the media content. Computers/tablets with internet connection are needed, at least for 1/3 or 1/4 of the pupils (they will join groups of 3-4, not necessarily the same as on the first session).

The teacher will stop the film at specific points where a question is raised to be solved by the class. First, the class will try to guess the answer by using their previous knowledge, without searching internet. Then they will surf the web for detailed answers. Once the question is solved, the video can be played on until the introduction part (or the available time) runs out.

Question block 1:

Which nationality is Subaru Telescope? (Answer: Japanese)

Where is it installed? (Mauna Kea, Hawaii)

Why is it installed so high? (To have clearer skies and less atmospheric distortion).

Solutions can be found on pages:

- https://es.wikipedia.org/wiki/Telescopio_Subaru
- <https://stardate.org/astro-guide/faqs/why-are-many-observatories-located-mountaintops>

Question block 2:

What is adaptive optics (AO)?

Why do they use lasers in AO?

Solutions can be found on page <https://www.youtube.com/watch?v=Ck9dn36ykk4>

Question block 3:

What is M85-HCC1? The densest known galaxy known, discovered by students, using Subaru. Solutions can be found on page <https://earthsky.org/space/tiny-but-still-densest-known-galaxies/>

Question block 4:

Why does the moon have craters?

Solutions can be found on page <https://morgridge.org/blue-sky/why-does-the-moon-have-craters/>

What are the protrusions on the satellites? (Solar panels)

Why are they necessary? (To supply the satellite with energy)

Question block 5:

What is the difference between comets/asteroids/meteorites?

Solutions can be found on page <https://www.youtube.com/watch?v=f3xzT-JPaY>

Question block 6:

How are discoveries reported in astronomy?



Solutions can be found on page <https://www.iau.org/public/themes/discoveries/>

How are comets named?

Solutions can be found on page https://en.wikipedia.org/wiki/Naming_of_comets

Question block 7:

What is the song behind “throw my telescope in the air sometimes” ?

Solutions can be found on page <https://www.youtube.com/watch?v=6rhV-7Xj70I>

Life of Galileo <https://www.youtube.com/watch?v=fTqxm0FqTOA>

Question block 7:

What is an AU?

Solutions can be found on page https://www.youtube.com/watch?v=wS_fEPyONs8



3. Annex I:

Background information

A day in the life of an astronomer: <https://www.youtube.com/watch?v=DrLPCEXsNb4>

How to become an astrophysicist: <https://www.youtube.com/watch?v=IVQ3yH-Zusg>

Information to the teachers

Space generation advisory council on NEOS: <https://www.youtube.com/watch?v=h-eOIkWOekY&list=PLz0tdbacLdIFZcjPjt7I3bA57GSVDYePU>

More on CNEOS programme: <https://cneos.jpl.nasa.gov/>

More on SCOUT programme: <https://cneos.jpl.nasa.gov/scout/intro.html>

More on Minor Planet Centre: <https://minorplanetcenter.net/iau/mpc.html>

Awesome animation on Asteroids: <https://eyes.nasa.gov/apps/asteroids/#/asteroids>

The motivation of the film explained by Leonardo DiCaprio: <https://www.youtube.com/watch?v=YEMaLsPTWlo>

The science in the movie explained by an astrophysicist: <https://www.youtube.com/watch?v=y4UFaENRONk>

VET Schools

All kinds of VET schools could do this activity.

