EDUCATIONAL COMPONENTS
-> DELIVERABLES 2019
IGF PAS is a leader of:

**Task 2.2.** Promote Arctic and climate change issues in education

**Sub task 2.2a.** To promote polar issues by providing educational resources within school organisations (local conferences etc.), brochure, video, newsletters for teachers

**Sub-task 2.2d.** Feedback on INTERACT educational resources. 3 CAWI surveys designed to collect feedback from teachers and support the development of new educational resources:

(a) teachers’ expectations and needs,

b) the usefulness of INTERACT’s materials, and

c) recommendations for future development of educational resources)
D2.1 1st CAWI survey – exploring teachers’ needs

The new educational materials would be used mainly on geography, nature, and biology lessons;
Among the suggested topics, the most interesting one for teachers was “Climate change – causes and consequences”;
Many teachers and educators are willing to use English, even if it’s not their mother tongue;
The most desirable types of new educational materials were “Multimedia presentations – PowerPoint”, “Movies”, and “Graphics and schemes”;
Respondents found “Websites/web portals” as the most useful way of communication between educational projects and teachers

D2.6 1st Newsletter issues for teachers
H2020 funded projects:

Community for Science Education in Europe – SCIENTIX

EDU-ARCTIC
2019 activities and results

D2.7 2nd Newsletter issues for teachers
D2.13 – Promotional brochure and video clip
D2.3 2nd CAWI survey report

INTERACT RESOURCES: EDUCATIONAL TOOL-KITS

PROMOTIONAL ACTIVITIES – increasing teachers’ network:

• Scientix webinar dedicated to ‘PERMAFROST’ educational tool-kit – 13 March 2019 https://youtu.be/oHBoju96KvA

• PEI (Polar Educators’ Forum) Cambridge

• 2 workshops for teachers within STEM Discovery Week 2019 (Warsaw, Poznań)

• Distribution of brochures - Educational Fair, Lublin, March 2019
INTERACT EDUCATIONAL RESOURCES BRING YOU CLOSER TO THE ARCTIC - AND SCIENCE!

They're available for free, online, and always ready to use.

https://youtu.be/Pn6CM1dXais

... influence environment and human kind ...

... long term and WORLDWIDE!
EDUCATIONAL MATERIALS

EDUCATIONAL TOOL-KITS

POLAR TOPICS – GLOBAL

PERMAFROST

GLACIERS

CLIMATE CHANGE

RESEARCH-BASED content

21st century skills

Trends
http://www.allourideas.org/trendiez/results

INTERNATIONAL NETWORK OF EDUCATIONAL MATERIALS BASED ON ACTUAL RESEARCH POLAR STATIONS

HANDS-ON ACTIVITIES

CURRENT TOPICS

USE OF SCIENTIFIC DATA

Educational TOOL-KIT

ARCTIC ISSUES

multimedia

students

STEM learning
game-based learning
virtual learning
project-based learning

webinars with experts

Polish Polar Station Hornsund Svalbard

47 Institutions
85 research stations

The NIBIO Svanahovd research station
Norway

The Faroe Island Nature Investigative

Explore, describe, analyze and discuss:
Scientific, social, economic and cultural aspects of the Arctic

Animations
Detailed, graphic presentation of processes

Syllabus
Basic concepts, key terms, mind map, glossary, extra resources

Lesson plans
Skill-based, subject-based, link to EU trends, 21st century activities with timetables, and lessons

5 big concepts to remember, mind map, glossary, extra resources

http://www.allourideas.org/trendiez/results

INTERACT
Each educational tool-kit contains:

- **SYLLABUS** – table of content with basic information and resources, links to crucial definitions, **mind map**
- **MATERIAL FOR TEACHERS** – comprehensive and reliable resource – „topic in a nutshell”, illustrations, Basic facts, Advanced material, **Research methods (!), 5 fun facts**
- **LESSON PLAN** – detailed, yet easily adaptable description of suggested activities (minute-by-minute) with **homework, preparation, goals, evaluation**
- **WORKSHEET** – hands-on activities for students, **based on actual research results + version for teachers** – with answers and explanation; online activities (**Educaplay, Kahoot**)
- **EXPERIMENT SCENARIO** – easy DIY, **engaging activities** without special equipment
- **PRESENTATION** – **PowerPoint**, ready to use for teacher as introduction
- **WEBINAR** – **recording** of 15 min lecture by an expert-scientist
- **ANIMATIONS** – narrated, illustrative explanations of phenomena
TOPIC 1: PERMAFROST

Active Layer
Thaws and refreezes every year
From ca 10 cm to ca 3 m thick

Permafrost
Always frozen
From ca 10 cm to ca 1400 m thick

Unfrozen material
Why should we care about what is going on with the permafrost?

Thawing permafrost = unstable ground

Carbon release

Anthrax outbreak in Siberia in 2016

Drunken forest
THINGS TO LEARN – 5 basic questions:
How does permafrost form?
Where is permafrost found?
How do researchers study permafrost?
What are the impacts of permafrost thaw?
How do we know where permafrost is?

WHERE IS IT STUDIED?
EXAMPLES OF POLAR STATIONS WITHIN INTERACT NETWORK:

RESEARCH STATION SAMOYLOV ISLAND

CHOKURDAKH SCIENTIFIC TUNDRA STATION

BARROW ARCTIC RESEARCH CENTER/ENVIRONMENTAL OBSERVATORY

POLISH POLAR STATION HORNSUND

SYLLABUS

How does permafrost form?
Where is permafrost found?
How do researchers study permafrost?
What are the impacts of permafrost thaw?
How do we know where permafrost is?
PERMAFROST IN A NUTSHELL

BASIC FACTS:
What is permafrost? How is it formed? Where can we find it? What is thawing? How is it different from melting? How does climate change affect permafrost? What are the consequences of thawing permafrost? Is permafrost the same everywhere? What are main landforms related to permafrost? Could permafrost be used?

RESEARCH METHODS:
How do scientists study permafrost? What can we learn from permafrost

ADVANCED MATERIAL:
Subsea permafrost Fire vs permafrost Yedoma Batagaika Crater

COULD PERMAFROST BE USED BY HUMANS?
Indigenous people of the Arctic used properties of permafrost for food storage and as a freshwater resource.
Athabascan (Alaskan native) Elder Robert Charles reports:

Our people have always used permafrost for storage of food. The method used was to build a birch bark basket out of the oldest birch tree that had a thick, heavy bark. You pattern it into a six foot square container, enough to hold food and berries and white fish. Then you dig down to where the ground is frozen, and even a foot into the frozen ground, for storage. Another significant use of permafrost areas is water. When we were out hunting in higher elevations, where water could be hard to find, we would find a spot where the ground was wet and chip away the tundra to make a hole. Soon you would notice very cold water seep upward from the permafrost.

Source: http://www.arcticclimatemodeling.org

WHAT IS THAWING? HOW IS IT DIFFERENT FROM MELTING?
‘Melting’ describes a physical phase change during a temperature increase when a solid substance is transformed into a liquid state. (like sea ice).
When something ‘thaws’ it warms up slowly and changes gradually from a frozen state to a temperature above freezing point. (think of defrosting meat).
Permafrost THAWS, while ice MELTS. Permafrost doesn’t totally change into liquid state, as it contains soil, organic material, rocks, sediments.
Permafrost acts like a lid, locking frozen carbon deposits deep below ground. The upper layer of permafrost thaws and re-freezes naturally each year. As the organic matter thaws, microbes degrade it – a process that releases carbon dioxide and methane.

HOW DOES THE CLIMATE CHANGE AFFECT PERMAFROST?
Increase of temperature ignites permafrost thawing, and that creates a vicious circle. Extra warming thaws more permafrost, leading to further warming – and so on. Scientists call a self-reinforcing warming cycle like this a positive feedback loop.
Permafrost degradation has occurred many times throughout geological history, but the rate of climate change, presence of substantial population, and diverse economic and land use activities in the Arctic, make contemporary permafrost degradation a unique process. The impacts of permafrost degradation are diverse and range from local to global, such as the potential enhancement of climatic change through emission of greenhouse gases. Observational data on permafrost characteristics are limited, but show permafrost temperature is increasing, whereas the active layer is progressively thickening in the majority of regions. Although climate change is the main driver of permafrost changes, other environmental characteristics may significantly alter these general trends.
PERMAFROST IN A NUTSHELL

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Is permafrost the same everywhere?
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Could permafrost be used?

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FUN FACTS
From frozen ground to space exploration
Studying environments that are similar to Mars helps to prepare biologists to identify traces of life in outer space.

“Exploding hills”
Volcano? Military action? UFO? Mysterious craters in Siberia startled the public

Frozen Pleistocene animals
Siberia is known for discoveries of well preserved carcasses of extinct animals, like The Selerikan pony, The Kolyma woolly rhinoceros, The Yukagir bison, or, most famous – Woolly Mammoth

Don’t die in Longyearbyen!

The town’s graveyard stopped accepting new inhabitants in 1950’. Why?

ICE PRINCESS
Permafrost enables natural preservation of archeological artefacts. In some cases, well preserved mummies can be found.
# LESSON PLAN

## BEFORE THE LESSON

### 1 PREPARATION ACTIVITY FOR ALL STUDENTS

**Procedure:** Students watch video recording with presentation by permafrost expert, 2 animations and try to fill in the worksheet

**Time:** 45’

**Resources:** Video recording, animations, Worksheet for students

## DURING THE LESSON

### 1Checking level of knowledge

**EDUCAPLAY WORDSEARCH activity solved together, with necessary clarifications**

**Time:** 5’

**Resources:** [Wordsearch](https://www.educaplay.com/en/learningresources/4213699/permafrost_interact_education.htm)

### 2 Working with resources

**Procedure:** Students are divided into 10 groups (1-3 students per group) each group obtains a topic to work on and a set of materials:

- WHERE CAN WE FIND PERMAFROST, IS IT THE SAME EVERYWHERE?

**Time:** 15’ (15’)

**Materials:** Materials for teachers, chosen sections from pages 2, 3 and 6

**Animations**

## TRENDS:

STEM learning

GAME-based learning and gamification

Virtual learning assistant

Project-based learning

21st century skills


Critical thinking and problem solving

Global awareness

Environmental literacy

## ONLINE ACTIVITIES:

**Educaplay:** WORDSEARCH (find 7 terms related to permafrost)


**Kahoot.it:** QUIZ (7 questions, 20 seconds for an answer, individual or team mode) – smartphones/tablets/computers required

[https://play.kahoot.it/#/k/3e04e142-1c03-4502-a3d1-537ad8c9e241](https://play.kahoot.it/#/k/3e04e142-1c03-4502-a3d1-537ad8c9e241)
Is this sentence TRUE or FALSE? (underline the correct answer)
Active layer is a thin layer of soil that forms below permafrost.
TRUE/FALSE
FALSE (it’s above permafrost – or an upper layer; this is where vegetation is present)
Offline:

<table>
<thead>
<tr>
<th>FOR THE EXPERIMENT</th>
<th>Large bowl with flat bottom/large transparent lunchbox</th>
<th>Garden soil (1/2 l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water (cold and boiling)</td>
<td>Hair dryer</td>
<td>Toothpicks (8)</td>
</tr>
<tr>
<td>Access to freezer</td>
<td>Ice cube maker</td>
<td>Plastic cups (2)</td>
</tr>
</tbody>
</table>

Mix about ¾ l of garden soil with ¾ l of water in a large bowl with flat bottom/large transparent lunchbox. Put several ice cubes, preferably in different sizes into the soil. Put 5 toothpicks, marking how deep they’re in the soil. (0.5 cm, 1 cm, 2 cm, 3 cm, 4 cm deep). Avoid ice cubes.

Freeze the container for at least 10 hours, -18 °C.

Check if ground is frozen and if toothpicks are stuck in.

Take the container out at least 45 min before the lesson.

You can use the hair dryer to accelerate the process of thawing.

In 10 minute intervals check state of toothpicks.

Pour boiling water into 2 plastic cups and place them on the surface in 2 opposite ends of the container, leaving the centre clear. Mark cups with marker: 1, 2

Use new toothpicks to check every 5 minutes how deep you can put toothpicks. Mark toothpicks with marker, measure the depth and fill in the table. Use new toothpick for each measurement.

<table>
<thead>
<tr>
<th>Time</th>
<th>Area CUP 1</th>
<th>Area CUP 2</th>
<th>Centre area</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 minutes</td>
<td>e.g. 5 mm</td>
<td>e.g. 4 mm</td>
<td>e.g. 2 mm</td>
</tr>
<tr>
<td>10 minutes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ANIMATIONS

Narrated by Terry Calaghan

PERMAFROST POLYGONS
PRESENTATION + WEBINAR RECORDING

Permafrost in a changing Arctic

Material compiled by Margareta Johansson, Lund University

15 minutes
Expert: Margareta Johannson
Let’s play!

Find 7 terms related to permafrost!


1. THAWING
2. METHANE
3. CLIMATE
4. ARCTIC
5. PINGO
6. PALSA
7. PEAT
The most important conclusions are:

- The most high valued materials were materials for teachers (topic in a nutshell with basic/advance information, research methods and 5 fun facts), and worksheet (hands-on activities for students); no significant critical remarks were given.

- Overall answers regarding how clear and comprehensive the evaluated materials is are positive, however, lower answers combines with positive assessment of proposed tools show that the matter is complicated, not well known, and the use of scientific data/results/language poses some difficulties to teachers/educators/students.

- Not all teachers had opportunity to test materials in time given, yet the general positive impact of those is assessed as high; also, it may indicate they have a very limited time to introduce polar issues to their students.

- Teachers are interested in further diverse topics, with a clearly dominant aspect of climate issues, which confirms results of first CAWI in 2017 - which they can conduct lessons about the Arctic; among then suggested topics, the most interesting one for teachers was “Climate change – causes and consequences”; also, social sciences-oriented topics were suggested.
Planned activities

D2.4 3rd CAWI survey report
D2.5 Recommendations to authors of educational resources
D2.8 3rd Newsletter issues for teachers

Cooperation with SCIENTIX AMBASSADORS from 5 countries (Germany, Spain, Croatia, Sweden, UK+ volunteer from USA)

Workshops for teachers
New topics of educational tool-kits?
Thank you and have a fruitful meeting!

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