

# STEM for inclusive schools

School Education  
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**(30 months)**

-1-



# STEM for inclusive schools



## Transnational Partner Meeting - TPM 2 Pedagogical Conference – Poland - Radom 3<sup>rd</sup> to the 5<sup>th</sup> of September 2024

### Status of WP 2 – STEM ACTIVITIES DESIGN AND OER – Part 1 LTTA 1 in Germany and example of the module weather station Presentation of the leading partner: University of Paderborn



Chair of Business and Human Resource Education II  
Prof. Dr. Marc Beutner

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# LTТА Paderborn

LTТА 1 – Inclusive Learning Models and Use of Digital Technologies in STEM – Germany

03rd to the 07th of June 2024

Done

-2-



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# Inclusion – Challenges at schools

Lack of Resources

Need of teachers for training and professional development

Need for a fit to syllabus, curriculum and instruction

Need to overcome attitudinal barriers and physical barriers

Need for social integration

Need for parental involvement

-3-

Need for mental health support

Need to address the needs of students from different cultural and linguistic backgrounds



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# LT TA Paderborn - Topics

**Discussion on Inclusion**

**Inclusion and challenges at schools**

**OER and the ways to use them**

**Creation of ideas and materials for WP2 and WP3**

-4-



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# The 25 Activities / learning units – arrangement based on the activity ideas with regard to STEM subjects



## Sciences

Physics

Chemistry

Biology

## Technology

digitisation  
IT /

Engineering

Mathematics

-5-



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# General Information

The purpose of these guidelines and templates is to support partners in developing tools / learning arrangements for WP2, in a cohesive way, and with the same style.

## **At least 25 STEM activities:**

**The partners will design at least 5 STEM activities in accordance with the determined activity format. Activities will be developed on the basis of greater use of digital technologies and sustainability.**

The following slides outline the structure of the tools / learning arrangements for WP2. After this, we will provide an overview of the different types of questions and templates that we can include in the serious game. We will be using H5P to develop interactive questions in each activity. As such, the types of questions that are outlined on the slides are chosen from the list of possible tasks that can be created and re-produced in different languages using H5P.



# Every partner creates 5 activities and addresses different subjects with them: example overview for UPB



| Activities                         | Physics | Chemistry | Biology | Engineering | Technology/I<br>T | Mathematics |
|------------------------------------|---------|-----------|---------|-------------|-------------------|-------------|
| Weather Station Project            | X       |           | X       | X           |                   |             |
| Coding of a simple Game            |         |           |         |             | X                 | X           |
| Roller Coaster Design              | X       |           |         | X           |                   | X           |
| Robotics in School                 | X       |           |         |             | X                 |             |
| Health Analysis for your community |         |           |         |             | X                 | X           |

**Activity  
example for  
UPB**

-7-



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# Structure of the STEM-Activities



Video about  
the  
experiment  
/ activity

Integration of  
YouTube  
Videos

+

Presentation  
with the  
subject-  
related  
backgrounds

and

integrated  
classroom  
tasks

+

2  
interactive  
H5P-  
tasks  
per activity

+

Worksheets  
for learners

+

Learning  
Outcome  
Matrix





# Example for the video



<https://www.youtube.com/watch?v=sdXPTl8k9bI&t=177s>

Video about  
the  
experiment  
/ activity

Integration of  
YouTube  
Videos

-9-



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# Example for the presentation

Use the presentation template.

We will provide you with an example for our weather station activity.

**Presentation  
with the  
subject-  
related  
backgrounds**

**and**

**integrated  
classroom  
tasks**

-10-



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# Possible tasks that can be created and reproduced in different languages using H5P



2  
interactive  
H5P-  
tasks  
per activity

There are a variety of different Activity Types available on H5P. Find free testing opportunities under: <https://h5p.org/>  
A complete version (with a fee) can be found under: <https://h5p.com/>  
Nevertheless, we will integrate a free complete version in our website: <https://stem4inclusiveschools.eduproject.eu/> which we will use in the project.

UPB will explain H5P also at the TPM in Poland.

To be able to standardise the content across the different serious games being developed, we propose to use the following 5 Activity Types throughout the challenges.

1. Single Choice (Text)
2. Multiple Choice (Text)
3. Drag and Drop (Text or Image)
4. Drag the Words (Text)
5. Filling in the Blanks (Text)



# Possible tasks that can be created and reproduced in different languages using H5P



2  
interactive  
H5P-  
tasks  
per activity

-12-



H5P- Tasks 2 about climate and the weather station - Instruments

Find the correct names of the instruments at a weather station and use it in the crossword.

**Across**

3 Which instrument do you use to measure temperature? (11)

5 Which instrument shows the direction in which the wind is blowing (4,4)

**Down**

1 Which instrument measures the humidity? (10)

2 Which instrument measures air pressure? (9)

4 In which instrument do you collect rain water? (4,5)

Buttons: Check, Show solution, Retry

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# Example for the worksheets

Worksheets  
for learners

Use the worksheet template:

 ETTER Our Inclusive Schools  
Project number: 2012-1-0011-1-0123-0-00001 

**Worksheet for the Activity:**  
The weather protocol – Creating a weather station  
name of the activity

**Task description:**  
Time to finish the task: 2 weeks

**Supplies:**   
The own weather station you created.

**Method:**   
Observation of the weather by using your instruments.

 ETTER Our Inclusive Schools  
Project number: 2012-1-0011-1-0123-0-00001 

**Worksheet for the Activity:**  
name of the activity

**Task description:**  
Time to finish the task: \_\_\_\_\_

**Supplies:**  
\_\_\_\_\_

**Method:**  
\_\_\_\_\_

 ETTER Our Inclusive Schools  
Project number: 2012-1-0011-1-0123-0-00001 

**Worksheet for the Activity:**  
name of the activity

**Task description:**  
Time to finish the task: \_\_\_\_\_

**Supplies:**  
\_\_\_\_\_

**Method:**  
\_\_\_\_\_

We will provide you with an example for our weather station activity.



# Learning Outcome Matrix

LEARNING DESIGN  
Worksheet (Version 2.0.0.0)

Name of the Activity: \_\_\_\_\_

|                                                             | Objectives                                                                                                  | Teaching and Learning activities                                                                                | Assessment |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|------------|
| During which the activity the participants will be able to: | The participants will be taught to achieve the specific outcomes through the following learning activities: | The participants will be assessed as they achieve the specific outcomes through the following assessment tasks: |            |
| Overall Learning period: 1 hour                             |                                                                                                             |                                                                                                                 |            |
| Instructional period: 1 hour                                |                                                                                                             |                                                                                                                 |            |

WP  
LIFE-Long Learning  
LIFE-Long Learning

Erasmus+

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# Example of a module: Creating a weather station

STEM4inclusive schools  
WP2 – Toolbox



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-15-



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# Structure of the activity

## **A** Introduction

### **about the topic**

What ´s the weather like?

Measurement devices at weather stations

## **B** Training phase

### **about the training**

Create your own simple weather station

-16-



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# A: About the topic

## **What's the weather like? Measurement devices at weather stations**

-17-



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# Definition!



## What is climate change?

Climate change refers to significant and lasting changes in the Earth's climate patterns, particularly those that have occurred since the late 19th century due to human activities. While the Earth's climate has always experienced natural fluctuations, the term "climate change" today is most commonly associated with the recent, rapid changes driven by human activity, especially the burning of fossil fuels, deforestation, and industrial processes.

**Climate change is a long-term change in the average weather patterns that have come to define Earth's local, regional and global climates. It is not the change of the weather from day to day. And it is becoming more challenging these days.**



# The climate change Video

-19-



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Let's have a look at this youtube video!



<https://www.youtube.com/watch?v=dcBXmj1nMTQ>



## Climate change and weather observation

- Weather observation helps us to forecast the weather for the next day.
- Moreover, weather observation with weather stations collects the necessary data to have also a closer look at the weather and the climate over longer time, e.g. over many years to provide information on climate change.



# The easiest weather station

- |                          |                  |
|--------------------------|------------------|
| Stone wet                | – Rain           |
| Stone white              | – Snow           |
| Stone steaming           | – Hot after rain |
| Stone not visible        | – Fog            |
| Stone moving             | – Storm          |
| Stone fallen to earth    | – Earthquake     |
| Stone not there any more | - Theft          |

-21-



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# Definition!



## What is a weather station?

A weather station is a site, located on land or at sea. Usually, it is equipped with instruments and tools to measure atmospheric conditions. These measurements are used to generate weather forecasts.

The idea is to analyse weather patterns and climate. Data are collected, analysed and stored.





## What sort of data do we collect in a weather station?

- temperature,
- atmospheric pressure,
- humidity,
- wind speed,
- wind direction and
- precipitation levels.

-23-



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# Different types of weather stations – Part I



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# Different types of weather stations – Part II



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Gerd Altmann – free licence



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– free licence



# Different types of weather stations – Part III



-26-



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Meli1670 – Melanie – free licence



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## What sort of instruments belong to a typical real weather station?

- Thermometer measuring air and sea surface temperature
- Barometer measuring atmospheric pressure
- Hygrometer measuring humidity
- Anemometer measuring wind speed
- Pyranometer measuring solar radiation
- Rain gauge measuring liquid precipitation over a specific period of time.
- Wind sock measuring general wind speed and wind direction
- Wind vane showing which way the wind is blowing.
- Evaporation pan measuring evaporation.

-27-



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Let's have a closer look at:

**Wind vane**

**Thermometer**

**Barometer**

**Hygrometer**

**Rain gauge**



-28-



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# A wind vane (also called weather vane or weathercock)



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-29-



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# Weather vane Video

-30-



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Have a look at this  
short youtube video!



<https://www.youtube.com/watch?v=-rQc4uYnBe8>

# The Thermometer Video

-31-



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Let's have a look at this  
youtube video on  
temperature  
measurement!



**HOW DO YOU MEASURE  
AIR TEMPERATURE?**

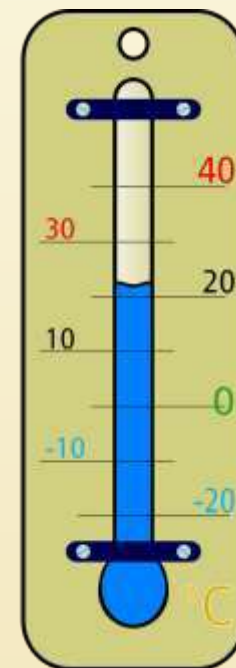
<https://www.youtube.com/watch?v=rARnTIPax8E&t=28s>



## How does a thermometer work?

### Liquid-in-Glass Thermometers

A thermometer is an instrument used to measure temperature. The liquid-in-glass thermometer is one of the most common types of thermometers, which uses a liquid (like mercury or colored alcohol) inside a glass tube. The liquid inside the glass tube expands when heated and contracts when cooled. The glass tube has a calibrated scale marked in degrees (Celsius, Fahrenheit, etc.). As the temperature increases, the liquid expands and rises in the tube. The level of the liquid indicates the temperature. When the temperature decreases, the liquid contracts and falls in the tube, again indicating the temperature on the scale.



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## How does a thermometer work?

### Digital Thermometers

The digital thermometer is an electronic thermometer that measure temperature using sensors.

They use a thermistor, a type of resistor whose resistance changes with temperature. As the temperature changes, the resistance in the thermistor changes, which is detected by the thermometer's electronics. The thermometer converts this resistance into a temperature reading, which is displayed on a digital screen.



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## How does a thermometer work? Infrared Thermometers

The infrared thermometers detect the infrared radiation emitted by an object. Every object emits infrared radiation, and the amount increases with temperature. The thermometer's sensor detects this radiation and converts it into an electrical signal.

The thermometer's electronics then translate this signal into a temperature reading displayed on the screen.



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## How does a barometer work? Part I

The Mercury Barometer is the traditional and oldest type of barometer, invented by Evangelista Torricelli in 1643. A mercury barometer consists of a glass tube filled with mercury, inverted in a dish (also containing mercury) called a reservoir or cistern. The tube is closed at one end and open at the other, with the open end submerged in the mercury in the reservoir. The weight of the mercury in the tube creates a vacuum at the top, and the atmospheric pressure pushes down on the mercury in the reservoir. This pressure forces the mercury up the tube.



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## How does a barometer work? Part II

The height of the mercury column in the tube corresponds to the atmospheric pressure.

Atmospheric pressure is typically measured in millimeters or inches of mercury (mmHg or inHg).

Standard atmospheric pressure at sea level is about 760 mmHg. As atmospheric pressure increases, it pushes more mercury up the tube. If pressure decreases, the mercury level falls. 1 mmHg is the same as 133 Pascal and 1,33 Hectopascal (hPa).



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## How does a hygrometer work?

### Mechanical (Hair-Tension) Hygrometer

A hygrometer is an instrument used to measure the humidity, or the amount of moisture, in the air. Hair, especially human hair, changes length based on the humidity level in the air. It lengthens when the air is more humid and shortens when the air is drier. In a mechanical hygrometer, a bundle of hair is connected to a mechanical lever system. As the humidity changes, the hair length changes, which moves the lever. The lever movement is transferred to a needle that points to a calibrated scale, indicating the relative humidity (RH) as a percentage. These hygrometers are simple, but they need regular calibration and can be less accurate over time. The relative humidity is measured in percent (0 to 100%).



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## How does a rain gauge work? – Part I

A rain gauge is a simple instrument used to measure the amount of rainfall over a specific period. It collects and measures precipitation, providing data that is essential for weather forecasting, agricultural planning, and hydrological studies. It typically consists of a cylindrical container.

The gauge has a funnel at the top that directs rainwater into a graduated measuring tube inside the cylinder.

The funnel ensures that all the rain that falls into the gauge is funneled into the measuring tube, reducing evaporation losses.



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## How does a rain gauge work? – Part II

The measuring tube is usually narrower than the outer cylinder, allowing for more precise measurements because the water level rises higher for a given amount of rainfall.

The tube is marked with a scale, usually in millimeters or inches, so that the amount of rainfall can be easily read.

After a rainfall event, the collected water is measured by observing the water level in the tube. The measurement represents the depth of rainfall that has fallen over the area covered by the gauge.

If the rainfall exceeds the capacity of the inner tube, the excess water overflows into the outer container, and the total is then calculated by adding the inner and outer readings.



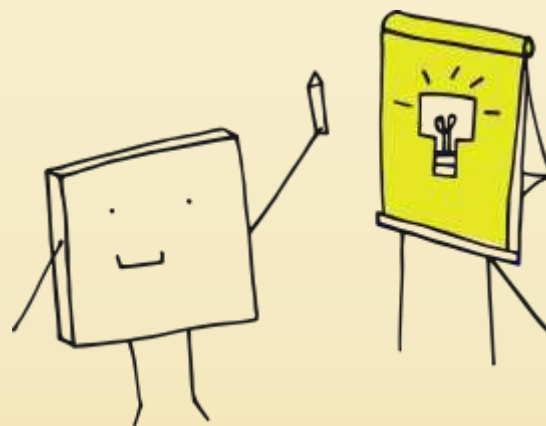
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# B: About the training



## Training phase



-40-



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# Task 1:

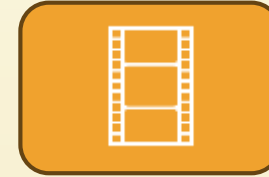
- Draw a plan for your weather station. Work together in groups of four persons and include also the learners who are not able to draw on their own by integrating their comments and ideas.
- You have 20 minutes for the creation. If you have people with special needs in your group you will get additional 10 minutes for the creation while the other groups have to check and improve their solutions
- Please, collaborate. Support learners with visual impairments or disabilities. Afterwards, everyone should share ideas





## Task 2:

- Let's have a look at the following video:



<https://www.youtube.com/watch?v=sdXPTl8k9bI&t=18s>

-42-

- Describe what you saw in a short text.  
If you are not able to write, please, work together with other persons or record an audio about your ideas with your mobile phone.



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# Task 3:

- Create your own simple weather station:
- Bring it outside and observe it for two week. Write down your observations in the observation protocol each day.
- Meet each other after the two weeks and share your observations and experiences. Everybody has to be involved according to discuss classroom norms and community agreements.





# H5P- Tasks 1 about climate and the weather station – Climate change

Is climate change currently a crucial topic for Europe?

☐ True ☐ False

[Check](#)

[Reuse](#) [Embed](#) H5P

-44-



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# H5P- Tasks 2 about climate and the weather station - Instruments

Find the correct names of the instruments at a weather station and use it in the crossword.

**Across**

3 Which instrument do you use to measure temperature? (11)

5 Which instrument shows the direction in which the wind is blowing (4,4)

**Down**

1 Which instrument measures the humidity? (10)

2 Which instrument measures air pressure? (9)

4 In which instrument do you collect rain water? (4,5)

[Check](#) [Show solution](#) [Retry](#)

[Reuse](#) [Embed](#)

-45-



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# H5P- Tasks 3 about climate and the weather station – Global climate

Drag the words into the correct boxes

Climate change is a  in the average  that have come to define Earth's local, regional and  climates. It is not the change of the  from day to day. And it is becoming more  these days.

[Reuse](#) [Embed](#) H5P

-46-



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# H5P- Tasks 4 about climate and the weather station – Thermometers

An infrared thermometer uses a resistor whose resistance changes with temperature.

☐ True ☐ False

A resistor is used in digital thermometers.

0/1 [Show solution](#) [Retry](#)

[Reuse](#) [Embed](#)

-47-



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# H5P- Tasks 5 about climate and the weather station – What is climate change?

What is climate change?

- ☐ Climate change is the change of the weather from day to day. And it is becoming more challenging these days.
- ☐ Climate change is definately unimportant
- ☐ Climate change is a long-term change in the average weather patterns that have come to define Earth's local, regional and global climates.
- ☐ Climate change is a short-term change in the average weather patterns that have come to define Earth's local, regional and global climates.
- ☐ Climate change is a medium-term change in the average weather patterns that have come to define Earth's local, regional and global climates.
- ☐ Climate change is a long-termed action and it is important for the EU.

✓ Check

Reuse <> Embed

H5P

-48-



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# Congratulation!

## You mastered the activity on climate and the creation of a weather station!

-49-



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