eSTEM

With the support of the Erasmus+ Programme of the European Union

DBL Example:

AERODYNAMIC CONCEPTS: drag and lift forces for wing profiles

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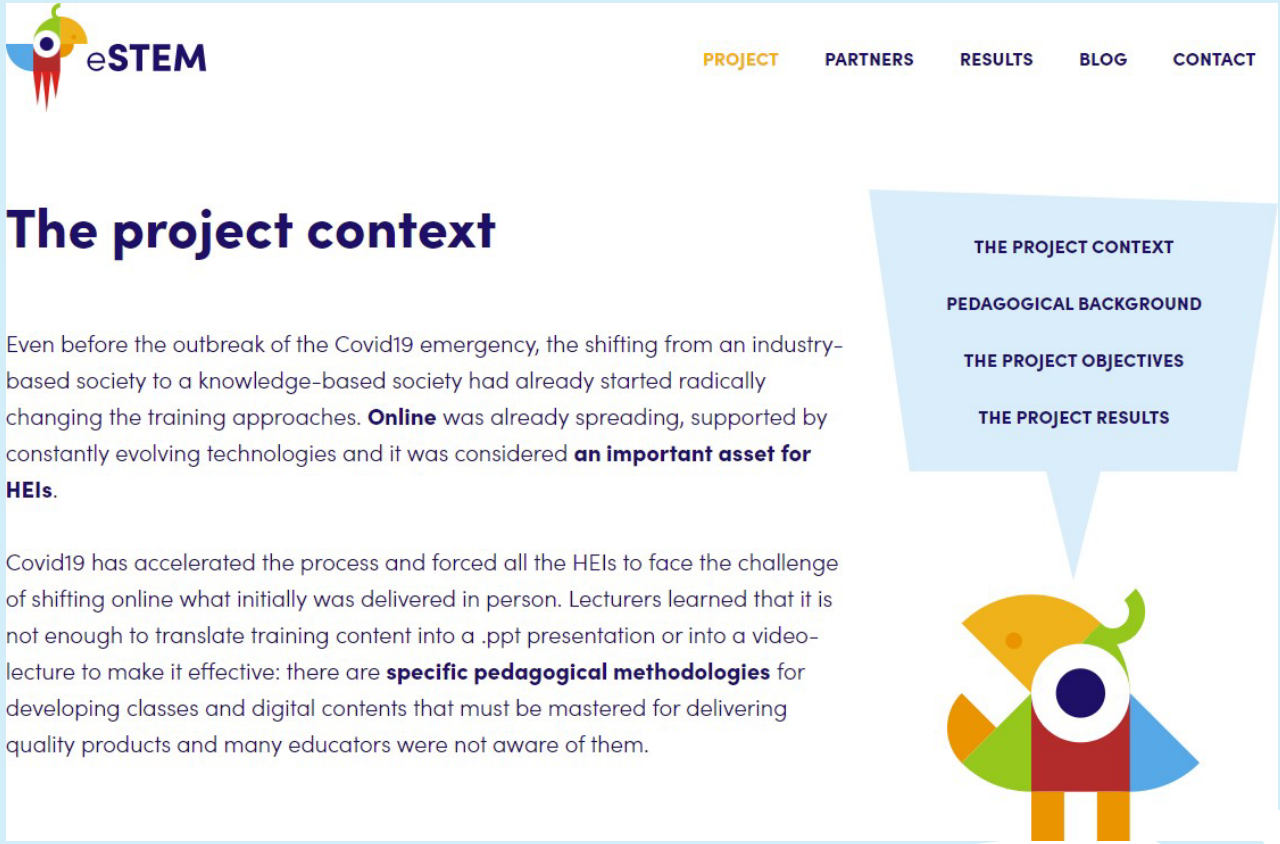
01.

Design Criteria of the DBL Activity

European Project eSTEM

- http://www.superfastlearning.eu
- Development and implementation of action-based learning lectures.
- eSTEM is designed for HEI lecturers and educators (academic professors, researchers, etc.) belonging to STEM Faculties.
- 4 active pedagogical methodologies: inquiry-based, problem-based, scenario-based, **dataset-based learning**

European Project eSTEM

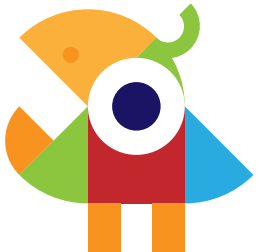


Lecture context

- Subject: Fluid Mechanics
- Degree: Bachelor degree of Mechanical Engineering

Intended Learning Outcomes (ILOs)

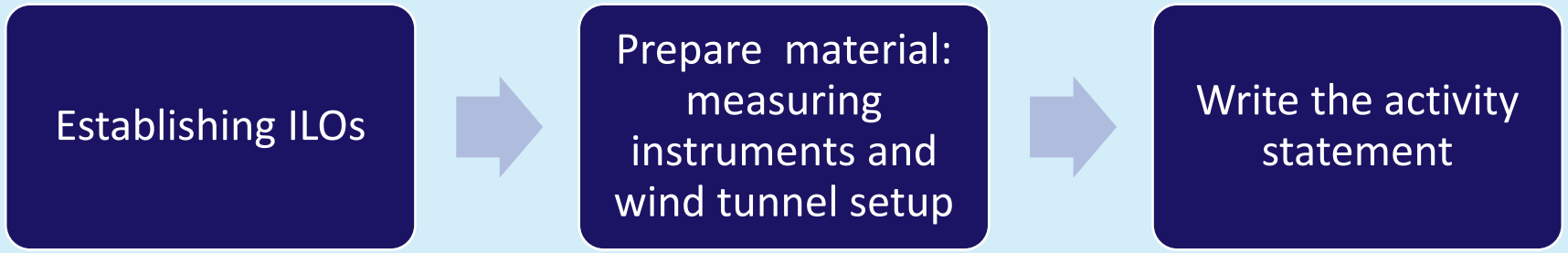
- Understanding fluid flow and forces
- Learning how to take measures
- Learning how to use instruments and components



02.

Activity Design

Course scripting



Lesson Flow

Synchronous learning:

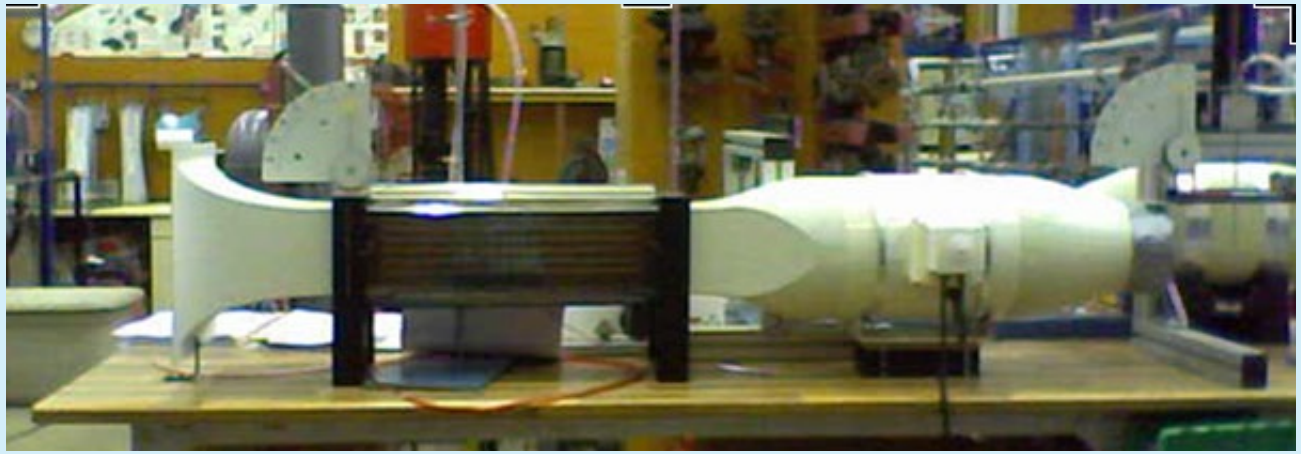
1. Description of the work to be done.
2. Description of the data sources.
3. Description of the results expected.
4. Short explanation of the process suggested to develop the task within the time assigned for the activity

After the lesson (asynchronous learning):

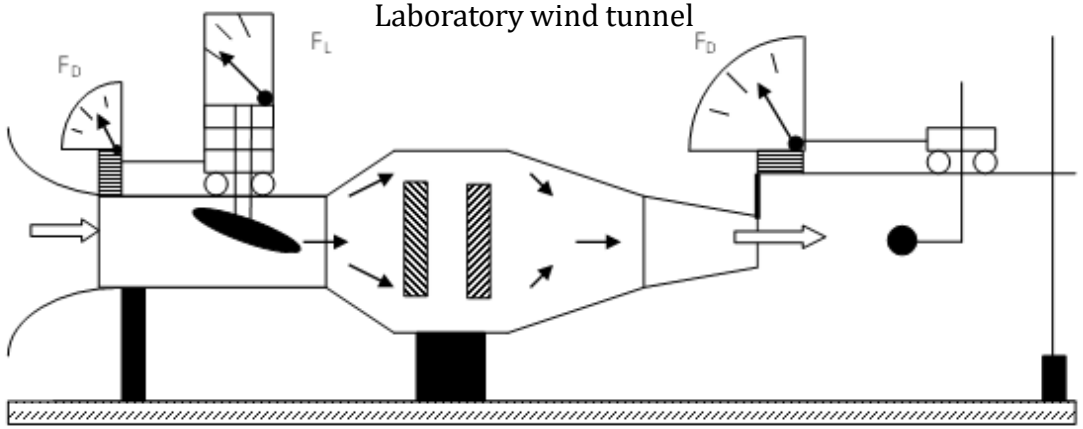
1. The students must prepare a report about the activity,.
2. The students must fill a questionnaire to evaluate the activity.

Materials needed

- Wind inlet
- Straight section with mobile floor
- Motor-driven fan
- Outlet nozzle
- Variable velocity with a potentiometer
- Torsion dynamometer
- Aerodynamic wing profiles



Laboratory wind tunnel



Lesson Flow

How is the measurement of drag and lift forces in the wind tunnel performed?

- Dynamometers are calibrated by choosing a horizontal position in the wing profile;
- Measures are 3 times repeated to assure an average value in every angle of attack
- Drag and lift forces curves are obtained vs the angle of attack.

AIMS OF THE ANALYSIS

- A dataset of drag and lift forces are provided.
- The data refer to experiments performed by different groups of students, in different academic years with different wing profiles.
- Other data obtained from SFLM machine with different drag and lift curves obtained from references for different objects are provided.
- By examining the drag and lift curves obtained for the wing profile selected by the students, they should infer information about the object and test conditions (velocity; angle of attack).

Laboratory measurement procedure

a) Take measurement of resistance forces with the dynamometer
b) Take measurement of lift forces with the dynamometer
c) Disassemble the floor of the wind tunnel
d) Insert the wing profile in the tunnel
e) Adjust the position of the wing profile to a horizontal level
f) Close the wind tunnel
g) Start the fan
h) With the potentiometer choose the maximum speed
i) Wait for the flow to stabilize
j) Take note of the values of the two forces indicated by the dynamometers
k) Repeat from point c) varying the position of the wing profile to cover different angles of attack from 0° to 14°

03.

Evaluation and optimization of the learning process

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