BLOOMING

Inclusion and Diversity in STEAM

Lesson Plan

If $x^2 + y^2 = R^2$ Is  then…….your life may be captured by analytical formulation!

Objective:

Students will be attracted by the search for the physical point of view, returned by the formulas! An obvious example is the phenomenon of resonance which is not predictable in the static but only dynamic field.

The lesson will explore the importance of physical meaning of the analytical formulations and the need to represent the real world through analytical formulations validated by experimental dynamic test.

If you succeed in this, you could realize a virtual experiment allowing the agreement of Leonardo da Vinci and Richard Feynman thinking: **a big challenge.**

Materials:

- Projector and slides on Static and Dynamics, Experimental Dynamics, Virtual experiment, Art and Math.

Erasmus+

- Internet access for research and data collection
- Video from internet and video from experimental test, run in the Experimental Dynamic Lab of University of Palermo.
- Sticky notes, markers, and flipchart for brainstorming sessions

Background Information:

From Static to Dynamics, to capture the resonance phenomenon, then real video of resonance and experimental test on resonance.
Introducing Experimental Dynamics.
A big challenge: the concept of virtual experiment.

Steps for Activity:

1. Introduction to Static and Dynamics in structural field (15 minutes):

- Begin by discussing the importance of capturing the difference between Static and Dynamic analysis.
- Explain the challenges posed by the pre-eminent difference to introduce the resonance phenomenon.
- Discuss the role of understanding formulations for safety.

2. Explore Resonance phenomenon (20 minutes):

- Divide the class into small groups. Assign each group a search of video showing resonance phenomenon.
  Ask each group to present the results of their video.

3. Introducing Experimental Dynamics and the big Challenge: Virtual Experiment (30 minutes):

- Visit to Experimental Dynamic Lab of University of Palermo.
- Showing experimental test through video and results
- Comparison between experimental and analytical results.
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4. Analyze Results and Discuss (20 minutes):

- Encourage a discussion on the importance of the match between the experimental and analytical results.
- Ask solutions.

Visualize and Discuss:

- Create a class to show that Art and Math are together!

Additional Discussion Points:

- Discuss how real-world is wonderful if based on Art and Math.

- **Challenges of Virtual Experiment:** Explore the challenges for considering Virtual Experiment.

- **Future of Structural Design:** Discuss how innovation could be improved studying math.

Assessment:

- Ask students to write a reflection on the following:
    1. What were the key challenges in studying Structural Dynamics ?
    2. What were the key challenges in studying Experimental Dynamics ?

- What role do virtual experiments play in the structural design
- Ask students to write a reflection on the way they perceive maths before and after this lesson.
- Students will also be evaluated based on their group presentations and participation the improvement of structural design through math &art!.

Reflection Questions:

1. When does the resonance phenomenon happen?

a) It happens when the amplitude of the force is very high.
b) It happens when the frequency of the force and the system are very different.
c) It happens when the frequency of the force and the system are very close.
d) It happens when the system is very flexible.

Answer: c) It happens when the frequency of the force and the system are very close.

2. What is one of the main challenges in integrating a deep knowledge of math into Structural design?

a) Creativity and technology improvement.
b) No challenge.
c) Technology improvement.
d) They are totally separated.

Answer: a) Creativity and technology improvement.

3. How can virtual experiments help safety?

a) By predicting different scenarios.
b) By increasing the cost of structural design.
c) By improve dynamic test.
d) By assessing the distance between math and structural design.

Answer: a) By predicting different scenarios.