

# (STEM) Science Technology Engineering Mathematics

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# Science Teaching through an English Module (STEM)

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# Little Crafts – Great Challenges

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# Introduction

**A cross disciplinary learning activity  
for 2<sup>nd</sup> grade junior high school students**

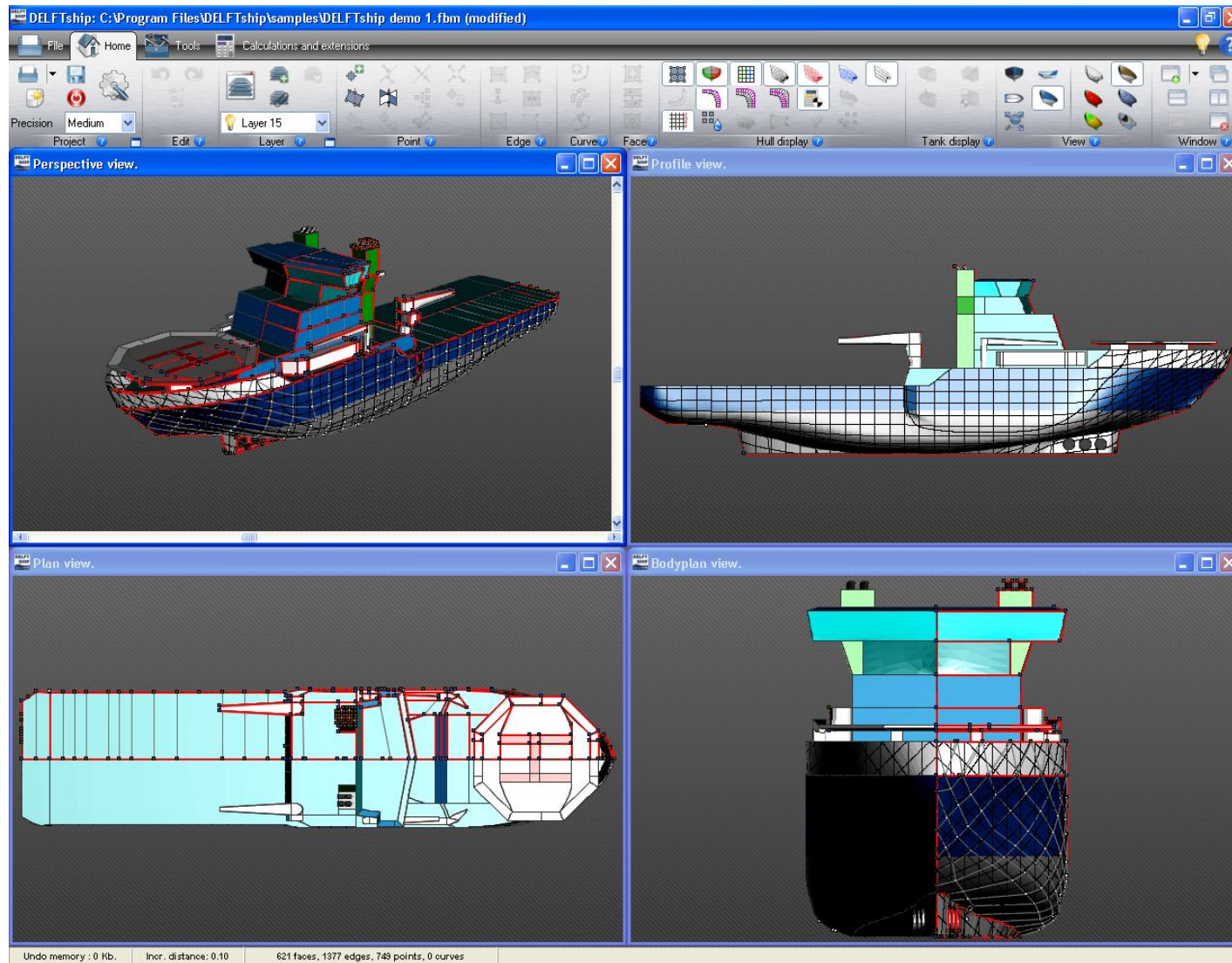
**Subjects:**

physics, maths, technology, engineering, english

# General description

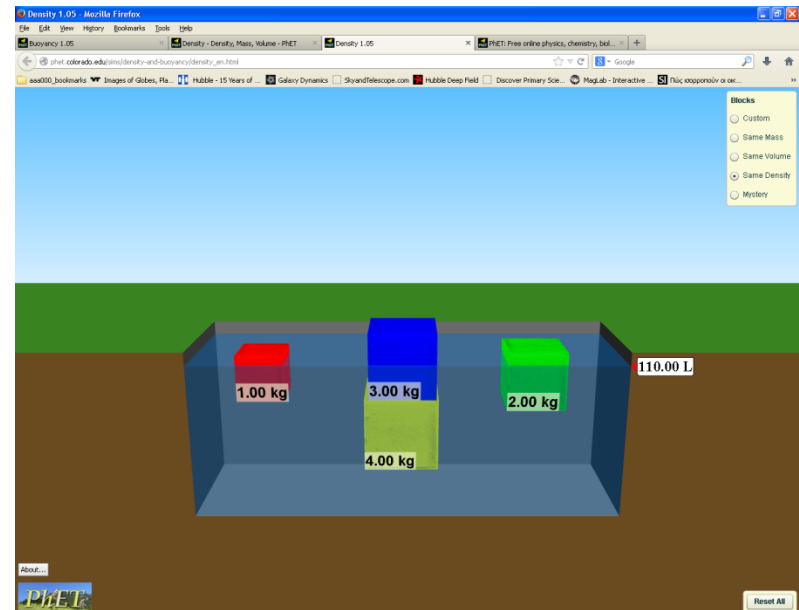
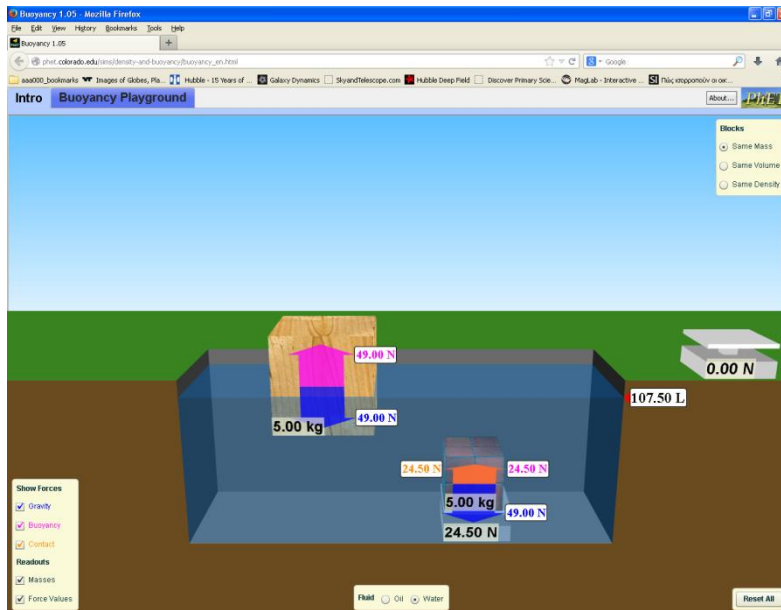
- Students split into groups and use a professional tool to design a ship to carry a payload
- Build a model with simple materials and test it in a **physical lab**
- Elaborate their knowledge with a **virtual lab**
- Acquire knowledge on **forces, motion, equilibrium, buoyancy, structural stability, modeling, engineering practices, ...**
- Improve social and verbal skills  
(collaboration, communication, presentation, project management)
- Develop key competencies (creativity, innovative thinking, problem solving)
- Compete with their models in the swimming pool
- The whole activity is conducted in English

# A professional 3D design tool



DELFTship™Free is a fully functional 3D hullform modeling program perfectly suited for students, home users or anyone else with an interest in ship design.

# Virtual lab



Students use a **virtual lab** to learn and elaborate on subjects like **forces, buoyancy, weight, mass, density**  
(curriculum connection: 2<sup>nd</sup> grade middle school physics, chapter "Forces and buoyancy")

# Physical lab to study buoyancy

**water tank**



**dynamometers**





# Remote online lab

The screenshot displays the 'Demo Go-Lab' interface, a remote online lab environment. The interface includes a navigation sidebar on the left with options like 'Demos', 'Archimedes Balls', 'Galaxy Collision', 'Inquiry Cycle', 'Hypothesis Creation', 'Galaxy See', and 'Twitter'. The main workspace contains several interactive elements:

- Top Left:** A video feed of a terrarium with a lizard.
- Top Center:** A video feed of a ball in a liquid, with a 'Take another picture' button below it.
- Top Right:** A video feed of a ball in a liquid, with a 'Process another picture' button below it.
- Bottom Left:** A diagram showing three colored circles (yellow, blue, red) with the text 'Throw the ball' below each.
- Bottom Center:** A flowchart diagram showing the process of 'Hypothesis', 'Orientation', 'Experimentation', and 'Conclusion'.
- Bottom Right:** A table of data for various materials, including air, current water, tank water, sunflower oil, alcohol, and salad water. The table includes columns for weight, density, and relative density.

On the right side of the interface, there is a 'Resources' section with icons for 'Camera 1', 'Camera 2', 'Ball Manager', 'Photo Capturer', 'Photo Process', and 'Spreadsheet'. The bottom of the interface features a 'Group Members' list and a 'My notes' section with text about modern physics.

**GO-LAB**

**Deusto**  
Universidad de Deusto  
University of Deusto

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About us Contact Help API Terms Support

Students connect and use an **online remote lab** located in Spain to learn and elaborate on subjects like forces, buoyancy, weight, mass, density (curriculum connection: 2<sup>nd</sup> grade middle school physics, chapter “Forces and buoyancy”)

# Categories - payloads

Students, split into teams of 4 or 5, are assigned/**challenged** to build a water-tight, strong, stable, streamlined vessel to carry a payload using only certain materials



vessel type: **dry bulk carrier**  
payload: **salt, 400 gr**



vessel type: **tanker**  
payload: **water, 500 gr, 0.5 lt**



vessel type: **supertanker**  
payload: **water, 1500 gr, 1.5 lt**

# Building materials

Low cost materials  
provided per team

**skewers**



**drinking straws**



**plastic forks**



**aluminum foil**



**baking paper**



**wrapping film**



... and ...

packaging string



**NO GLUE**

Students, split into teams of 4 or 5, are assigned/**challenged** to build a **water-tight, strong, stable, streamlined** vessel, if possibly resembling the model they designed, to carry a payload using only certain materials

Depending on their inclinations, skills and interests students in each team may undertake specific roles e.g.

- design expert,
- construction expert,
- navigation expert,
- management expert,
- presentation expert
- ...



# Speed race

This is an optional, but definitely fun and memorable, event to complete the activity

Teams compete with their models at the school's swimming pool using a simple pulling mechanism (fishing reel)

The design with the best hydrodynamic and structural properties wins the race if navigated properly  
(one race per category with/without load)



# Challenges

- use a professional 3D design tool
- build a water tight vessel that resembles the designed model, has the structural strength to carry the payload, and is light-weighted, stable and streamlined to be fast enough to win the race
- acquire and practice knowledge on forces, motion, equilibrium, buoyancy, structural stability, modeling, engineering practices
- document (written report) and communicate (presentation/poster) the various steps of the project in English

# Phases of the activity

The activity may have a free-form development or be structured in phases

The duration of each phase is adjusted by the teacher

Presentations  
posters - exhibition

Race

Report

Study-test in lab

Build

Design

1. Design
2. Build
3. Study – test in physical/virtual lab
4. Report
5. Race
6. Presentations – posters

# Why should I do this project ...

## Because ...

- Your students will love it
- Children learn more effectively when they are challenged, resume adult's roles, have fun
- This is not a project about physics only. It is about ...  
physics + maths + technology + engineering + english  
+ digital skills + creative learning + inquiry learning + ...
- In 2013 we celebrate the 2300th birthday of Archimedes  
([Greek: Αρχιμήδης](#); c. 287 BC – c. 212 BC)
- Greece is surrounded by sea and we all swim due to buoyancy
- Greek shipowners control, in terms of deadweight tonnage,  
23.55% of the world tanker fleet (crude oil tankers),  
17.20% of the world bulk carrier fleet and  
12.51% of the world chemical and product carriers fleet

Source: IHS Fairplay World Shipping Encyclopaedia, January 2013



# Highlights from the actual activities

Since 1/1/2014 (every Thu afternoon)

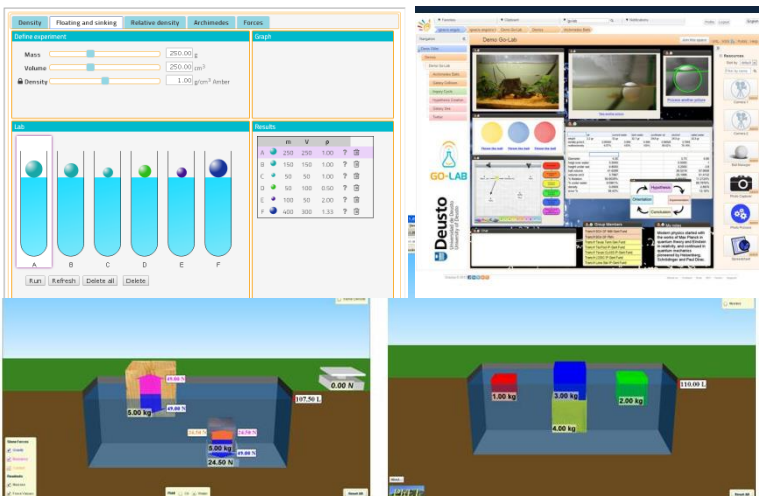
Subjects: physics, technology, engineering

Labs: splashlab, Phet, aquarium

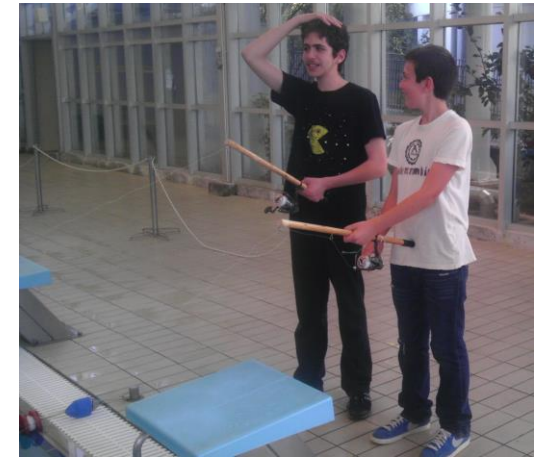
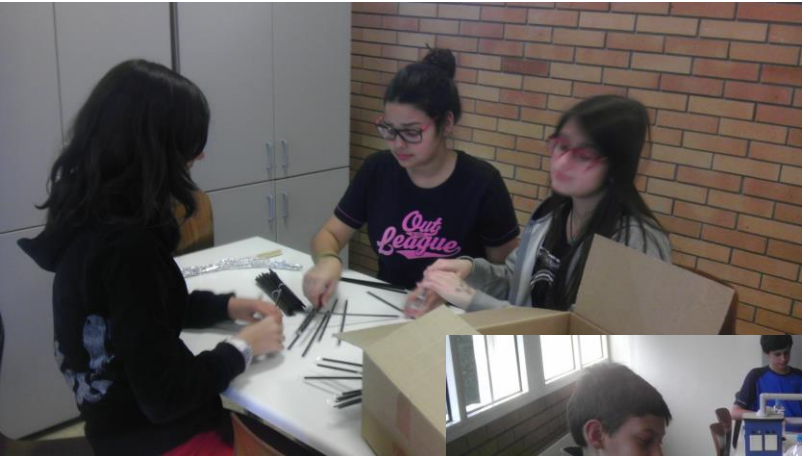
Students: 12-14 year s old

Pilot school: Gymnasio Ellinogermanikis

Activity: buoyancy, design and build a model ship



# Highlights from the actual activities




# Highlights from the actual activities







# Highlights (Corfu island 2014)



 ΜΙΚΡΕΣ ΚΑΤΑΣΚΕΥΕΣ  
μεγάλες προκλήσεις

   
Global Online Science Labs for  
Inquiry Learning at School

## ΕΠΑΙΝΟΣ

Απονέμεται στον/στην

..... για τη συμμετοχή του/της στον  
εκπαιδευτικό διαγωνισμό «Μικρές κατασκευές – μεγάλες προκλήσεις, με θέμα την άνοση»  
που διοργανώθηκε από το Εργαστηριακό Κέντρο Φυσικών Επιστημών Κέρκυρας την  
περίοδο 1 Απριλίου - 7 Μαΐου 2014 στο πλαίσιο του έργου  
“Global Online Science Labs for Inquiry Learning at School (Go-Lab)”  
το οποίο υλοποιείται με την υποστήριξη της Ευρωπαϊκής Επιτροπής.

Ο διαγωνισμός έγινε υπό την αιγίδα της Διεύθυνσης Δευτεροβάθμιας Εκπαίδευσης Κέρκυρας και με την ευγενική φιλοξενία του  
Ναυτικού Αθλητικού Ομίλου Κέρκυρας

**Δρ. Γεώργιος Μαυρομανωλάκης**  
Εθνικός Συντονιστής Εργίου, Επιστημονικός Υπεύθυνος Διοργάνωσης  
Τμήμα Έρευνας και Αξιολόγησης, Ελληνογερμανική Αγωγή

**Παναγιώτης Μουρούζης**  
Υπεύθυνος Εργαστηριακού Κέντρου  
Φυσικών Επιστημών Κέρκυρας

# Thank you

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