The Go-Lab ecosystem

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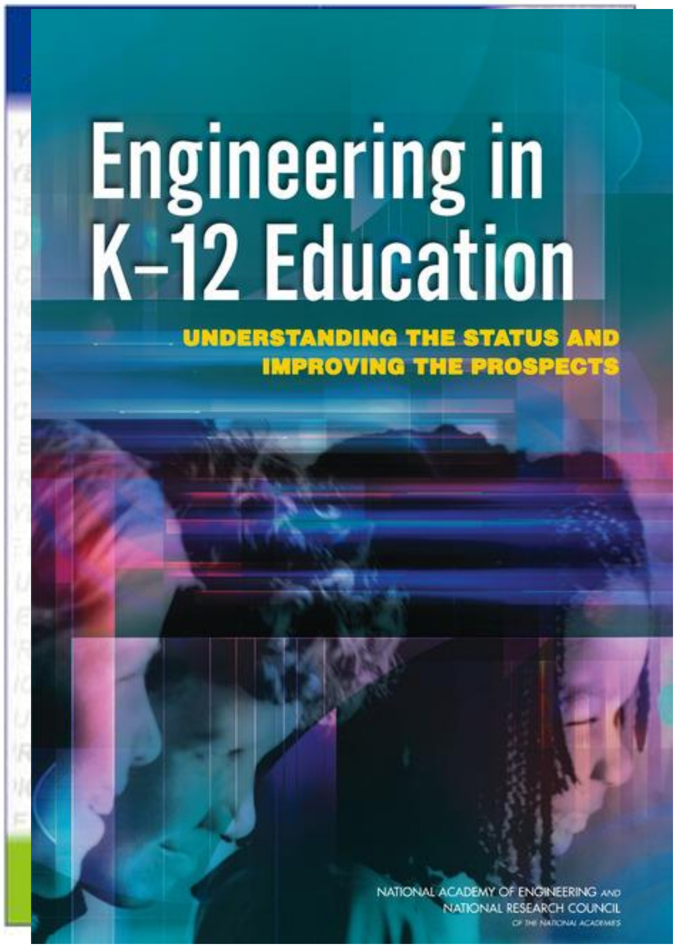
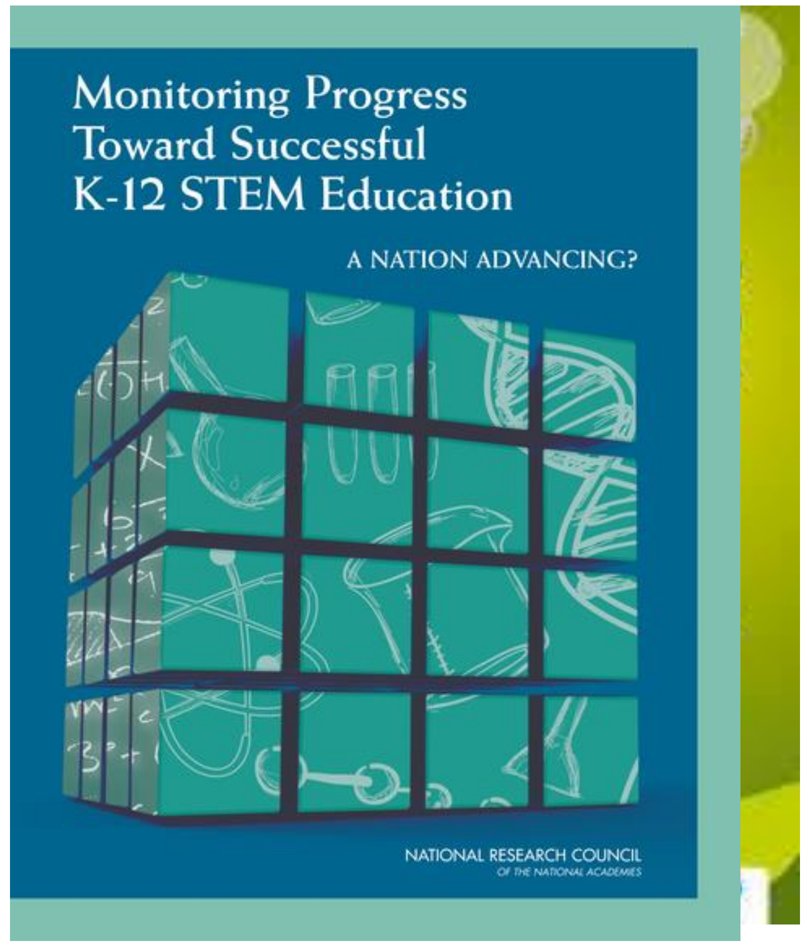
Roadmap

- A need for engaging education
- Active learning/inquiry learning/online labs
- Embedding inquiry/online labs
- The Go-Lab ecosystem
  - Sharing platform
  - Authoring platform
  - Tutoring platform
- Simulations for University level physics
- Examples

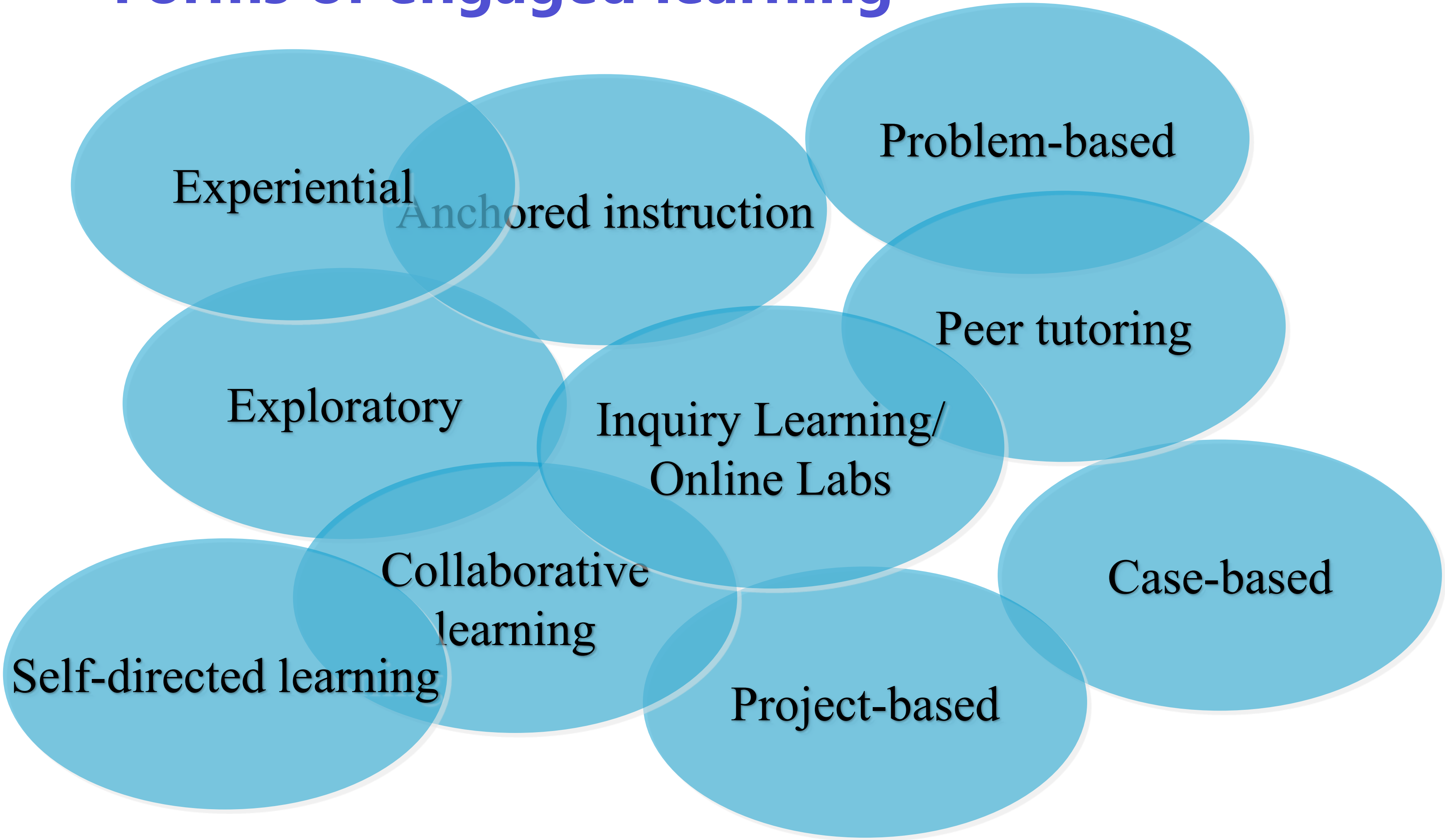
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731685.

We need engaging (science and engineering) instruction

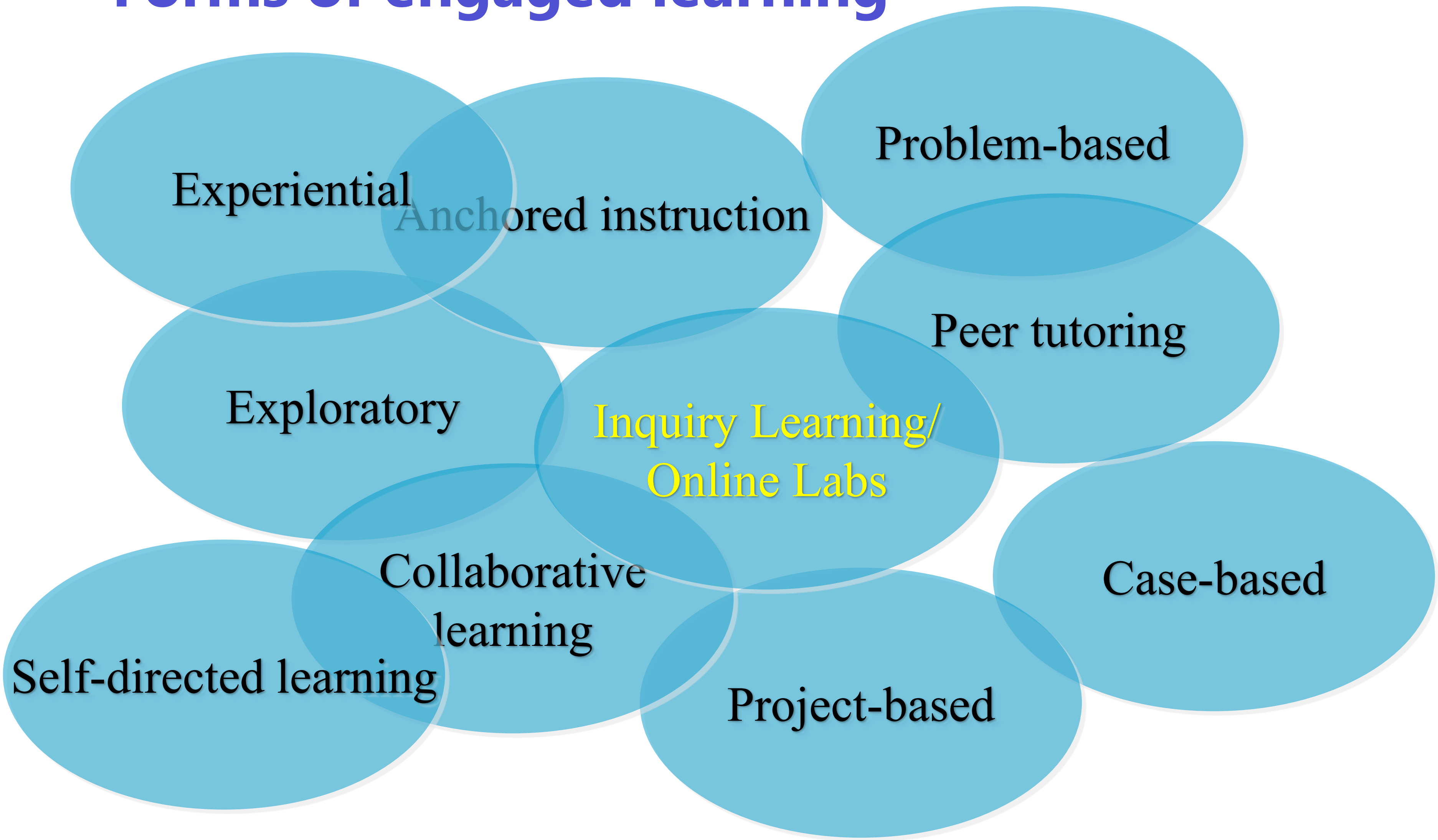




Forms of engaged learning



Forms of engaged learning



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Inquiry learning

Inquiry is an approach to learning that involves a process of exploration, that leads to asking questions and making discoveries in the search for new understandings

Based on "Foundations", Vol, 2, NSF, 2000

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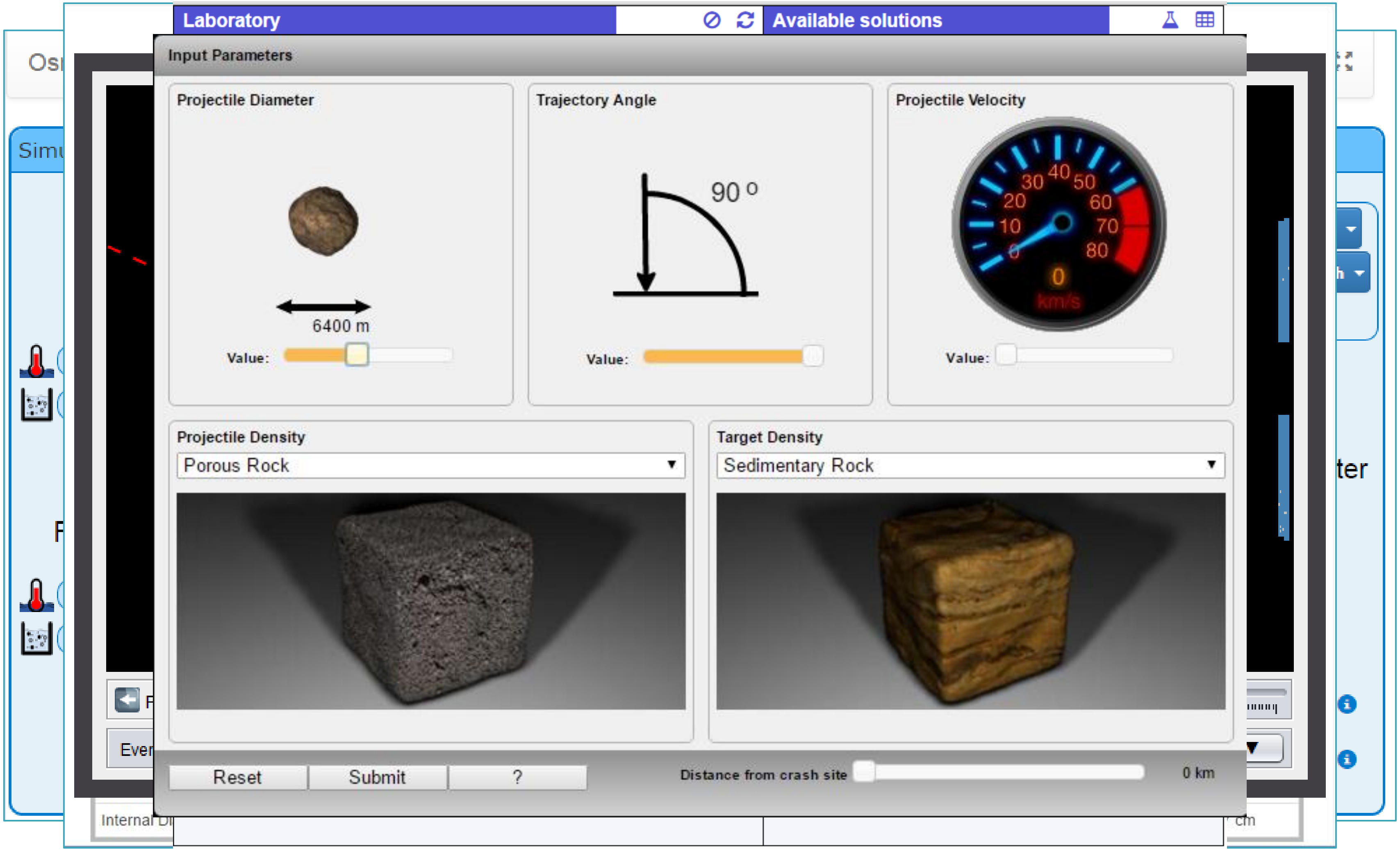
The role of technology

Online labs


Laboratory
Available solutions
Input Parameters
Projectile Diameter
6400 m
Value:
Trajectory Angle
90 º
Value:
Projectile Velocity
10 20 30 40 50 60 70 80
0
km/s
Value:
Projectile Density
Porous Rock
Target Density
Sedimentary Rock
Reset
Submit
?
Distance from crash site
0 km

PhET INTERACTIVE SIMULATIONS
OnlineChemLabs DEMO
SimQuest: An alternative way of learning
VIRTUAL LABS
An Initiative of Ministry of Human Resource Development (MHRD) Under the National Mission on Education through ICT
Objectives of the Virtual Labs:
ChemCollective
Online Resources for Teaching and Learning Chemistry
RESOURCE TOPIC: Acid-Base Chemistry
Strong Acids and Bases
Central Forces
Reference Frame
Virtual Labs at Amrita Vishwa Vidyapeetham
Developed @ Amrita University
Biotechnology and Biomedical Engineering
Chemical Sciences
Physical Sciences
Computer Science
Mechanical Engineering
Learn.Genetics
Virtual Labs
EU-HOU
Classroom experiments and activities
Remotely Controlled Laboratory Experiments - Classical Physics
Library of Labs

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Are online labs effective?

- Inquiry-based learning with online labs (and simulations) shows an advantage over expository instruction
- Students in online labs gain the same level of knowledge or a more advanced level of knowledge than students who learn in a real laboratory
- Online labs are only effective when well structured and designed, this is guidance, e.g., scaffolds included

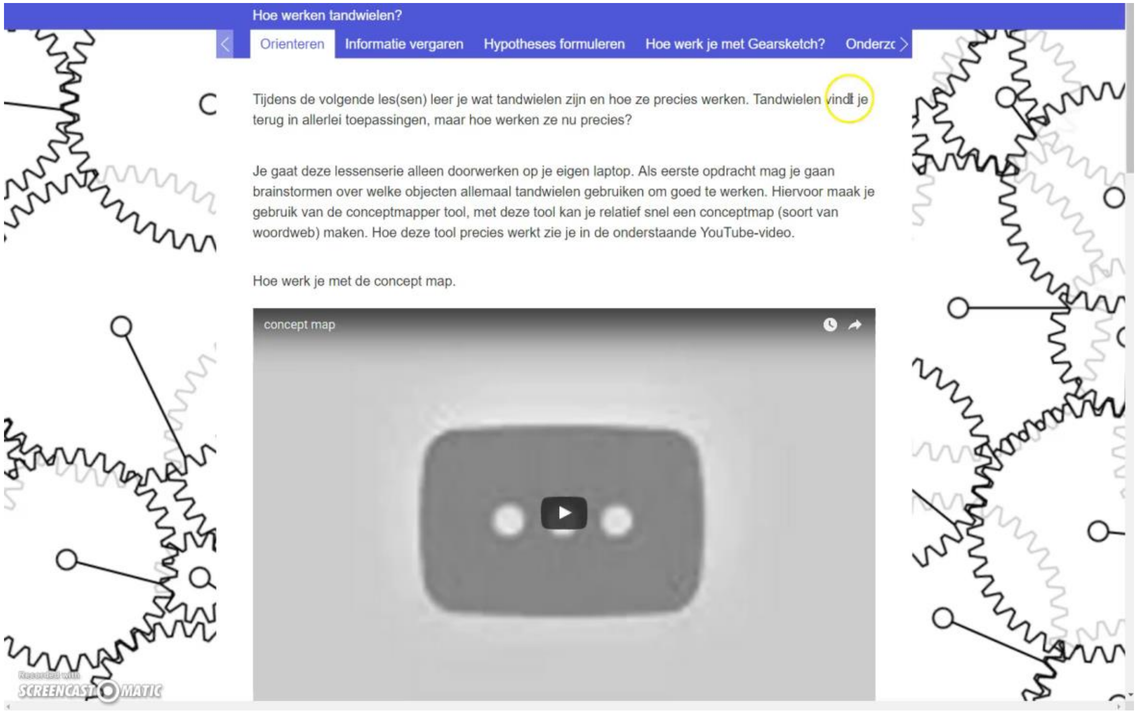
de Jong, T. (2006). Computer simulations - Technological advances in inquiry learning. *Science*, *312*, 532-533.

de Jong, T., Linn, M.C., & Zacharia, Z.C. (2013). Physical and virtual laboratories in science and engineering education. Science, *340*, *305-308.*

The Go-Lab innovation

- Many single applications
- Repositories of labs
  - PhET   Chemcollective   Physlets   PhysicsInteractives
- Repositories of labs with embedding
  - Online Chem Labs   AMRITA
- Repositories with embedding and scaffolding
  - SimQuest
- Repositories with embedding, “scaffolding” and authoring facilities
  - WISE
- Federation with embedding, interactive scaffolding, authoring facilities, and authoring support
  - Go-Lab

Inquiry Learning Space



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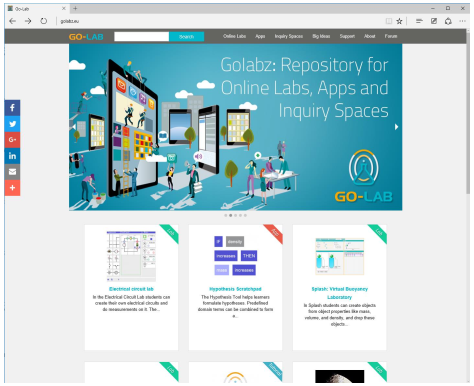
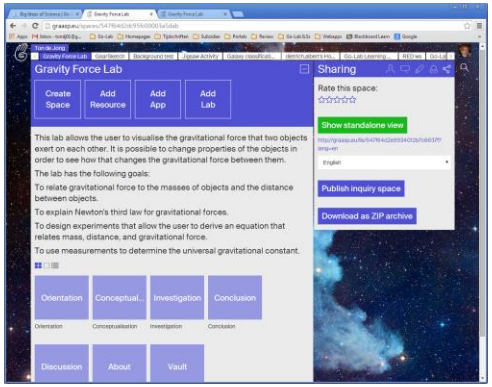
The Go-Lab ecosystem



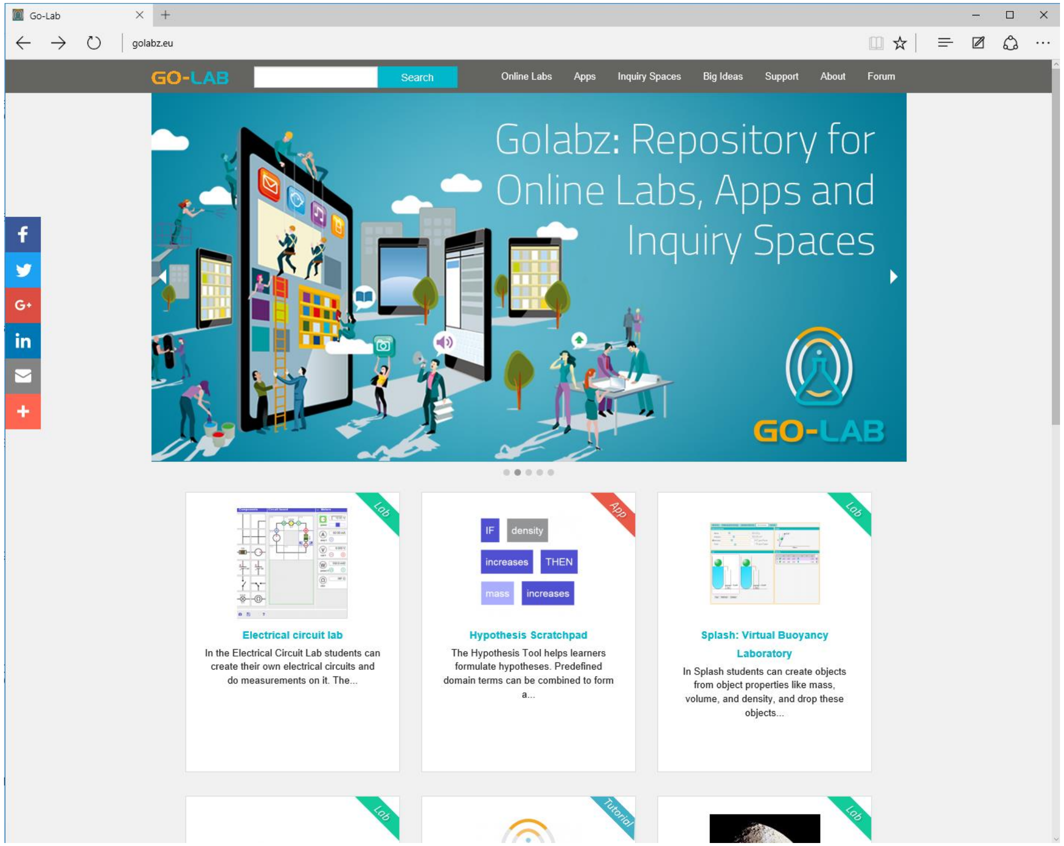
Sharing platform



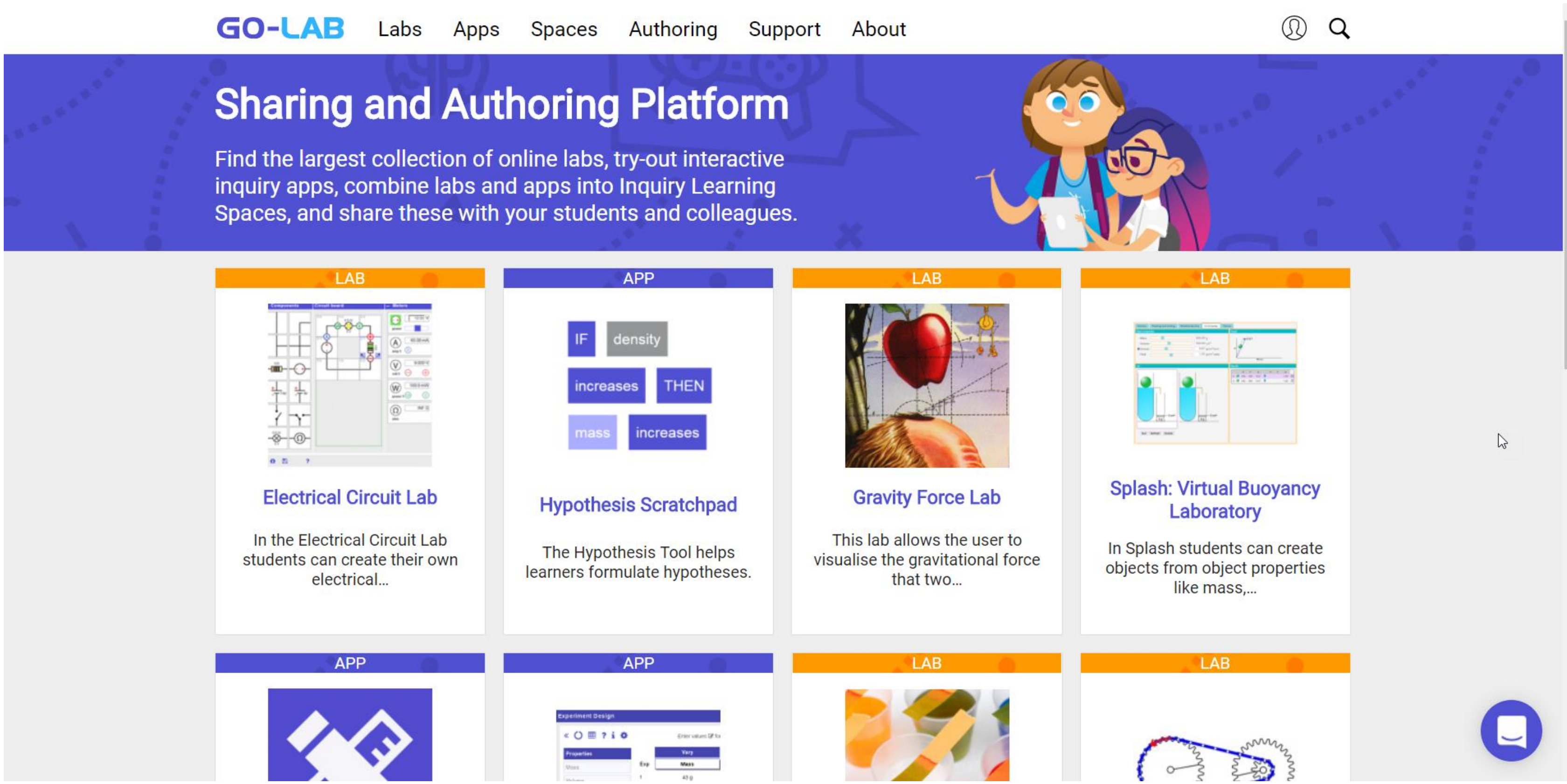
Authoring platform

Support platform

The Go-Lab sharing platform (www.golabz.eu)



New Golabz interface



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What makes Go-Lab unique?

- It collects online labs from around the world in one portal
- Teachers can combine each lab with texts, videos, and apps (scaffolds) in structured learning environments and very easily adapt these to their own needs
- These learning environments can be distributed to students with one click of the button
- And they can be directly shared with other teachers who can re-use them by copying and adapting
- And much much more …

Is Go-Lab a success?

- Go-Lab sharing platform unique users:
  - 2014: 10,718 users
  - 2015: 15,152 users
  - 2016: 78,384 users
  - 2017: 53,476 users (until August)
  - 2017: 91,673 users (extrapolated)
- USA, Spain, UK, Greece, Portugal, the Netherlands, Germany, Italy, Turkey, Estonia, Switzerland, …

Statistics

The repository contains:

- 487 Labs.
- 621 Inquiry Spaces.
- 42 Apps.

Teachers' opinions on Golabz

What do you think?

Simulations for University level physics

- Aimed at undergraduates (optionally, higher secondary education)
- Material tends to be abstract and mathematical
- Even difficult to think of appropriate visualizations (for developer and teachers)
- Much physics has a "single solution": makes inquiry difficult

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Example: Vector fields

- Used in many domains (e.g., electromagnetism)
- Difficult to visualize (vectors at each point in a 3D space)
- Three talks on visualization of vector fields and field lines at Multi-media and physics conference (2017)
  - One keynote: with a virtual reality solution (walk in a vector field)
  - Dynamic visualizations are particularly hard (which field lines to select)
  - Tens of years of research
- http://go-lab.gw.utwente.nl/production/radar/build/del.html

Example: Quantum mechanics

- “Realistic" visualisations are dangerous because of particle-wave duality
- See Road to reality by Roger Penrose for how a prominent researcher uses drawings to illustrate (understand) abstract concepts
- Double slit demo:
- http://go-lab.gw.utwente.nl/sources/tools/qm/qm.html

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Example: Space oddity or the taming gravity

goo.gl/SCDVvi

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Example: Space oddity or the taming of gravity in an ILS

goo.gl/FyvRBT