Modernizing collaborative digital education in emerging regions with active learning methodologies

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Thoughts about collaboration:

In Research

- As researchers we collaborate internationally with our peers
  - Of course: High competition on our home turf!
- Collaboration is recognized as giving **higher quality**
- **Peer review** is essential for publication
- Collaboration increases changes for citations and personal ranking
  - Promotion depends upon it

Thoughts about collaboration:
In Education

- Do educators collaborate internationally with peers?
  - No competition at all on our home turf!
- Is collaboration recognized as giving **higher quality?**
- How do we perform **peer review?**
- Collaboration should increase changes for citations and personal ranking
  - Does promotion depend upon it?

Collaboration in Emerging Regions

- Lack of collaborative work to create or share learning material
  - Limited resources (physical and digital)
  - Digital divide (limited access to information and technology)
  - Lack of training and awareness
  - Cultural factors
- Educational material is closely guarded by educators as a personal or proprietary asset!!

Ask yourself…

- In the last 3 years…
  - Have you had a journal/conference article reviewed?
  - Have you yourself reviewed articles?
  - Has your educational material been peer reviewed ?
  - Have you yourself reviewed educational material from someone?

Digital Transformation in Education

- **Before Covid19:** Remote education was a “no-no”
  - Teaching: I must see my students in the eyes
  - Labs: Will never give equal value
- **After Covid19**
  - Teaching: Everyone doing it (Zoom, Teams)
  - Labs: Can help a lot
- But do we do ”remote” correctly?
  - Focus too much on teaching vs learning?

Reading in a Library…

More than 900 years ago (Bologna 1080)

Nowadays…

And going to class

Do we still need this?

Focus on learning, not teaching

- **Self-paced (at your own speed)**
- **Any where**
- **Any time**
- **Just in time**
- **Collect knowledge (and points as assessments)**
- **How to get creativity into “not physical meetings”?**
- **How to create remote collaboration**?

New way of collaboration in education

- **Educators** share basic educational material
- **Educators** re-use basic educational material
  - Prevent the Not-Invented-Here (NIH) syndrome
- **Educators** collaborate to improve educational material and to create common courses
- **Educators** collaborate towards (common or not) not-for-profit programs (academic, professional)
- **Educators** review learning material from others for quality
- **Students** prepare themselves before class
- **Students** establish themselves their “missions” and personal learning journeys

A Paradigm shift

- Applying Active Learning Methodologies
  - Flipped-classroom
  - Challenge-based Learning
  - Remote Laboratories
- Educator-to-educator collaboration to develop, co-create, share, re-use, translate, digital learning material
- Educators in emerging regions require support for this shift!

The EXPLORE Energy Digital Academy (EEDA)

- Educator to educator collaboration in emerging regions
- Erasmus+ ”Capacity Building in Higher Education” Projects
  - **EUSL-Energy** (Sri Lanka, France, Netherlands, Sweden)
  - **EUBBC-Digital** (Bolivia, Brazil, Cuba, Belgium, Netherlands, Romania, Spain, Sweden)
  - **EU-BEGP** (Bolivia, Ecuador, Guatemala, Peru, France, Spain)
  - **EDU-ABCM** (Cameroon, Ethiopia, Mauritius, Mozambique, Italy, Sweden)
  - **EU-ZW** (Zimbabwe, Spain, Sweden)
- 42 partner universities in 21 countries in 4 continents

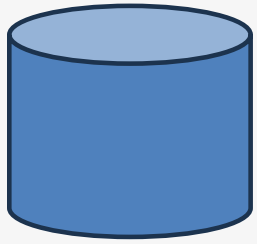
Co-funded by the Erasmus+ Programme of the European Union

EXPLORE Energy Digital Academy

Overview of EEDA

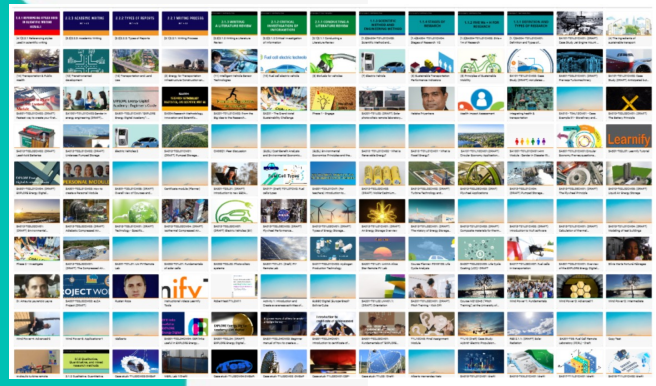
Network of Educators

Digital tools

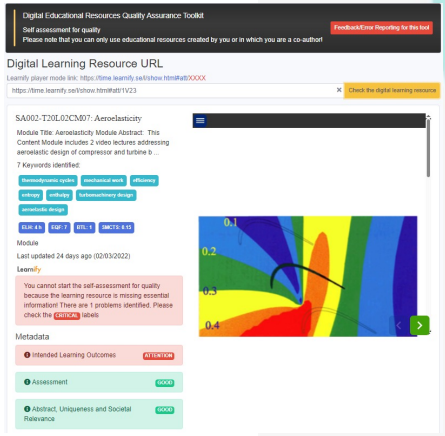


Repository

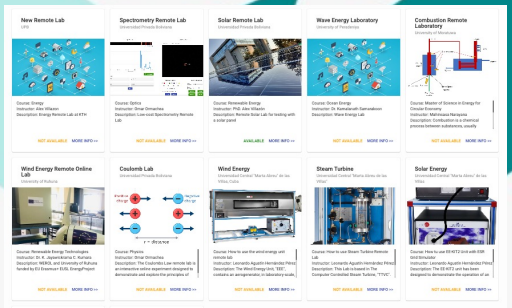
Co-created learning material



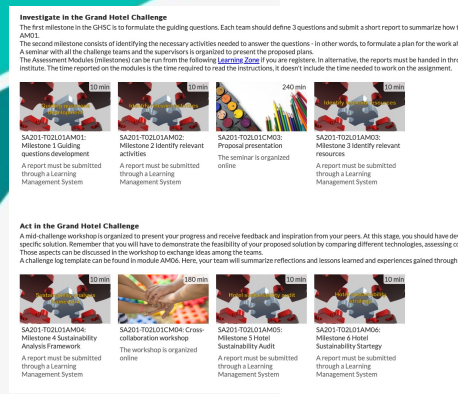
Tool for Quality Assessment



Remote Laboratories



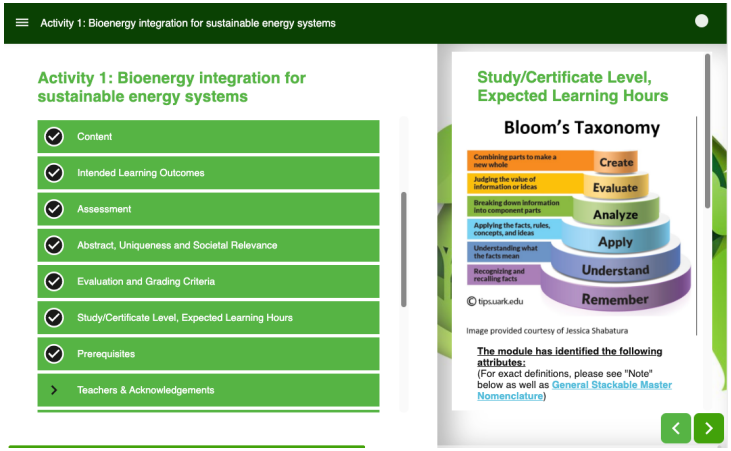
Challenge-based Learning



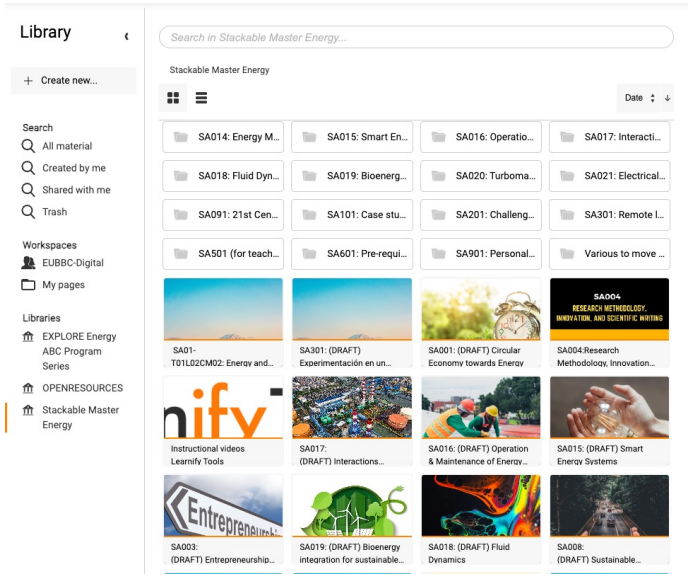
Basic unit of learning material: a Module

Module

0.5 to 5 (ELH)
Estimated Learning Hours



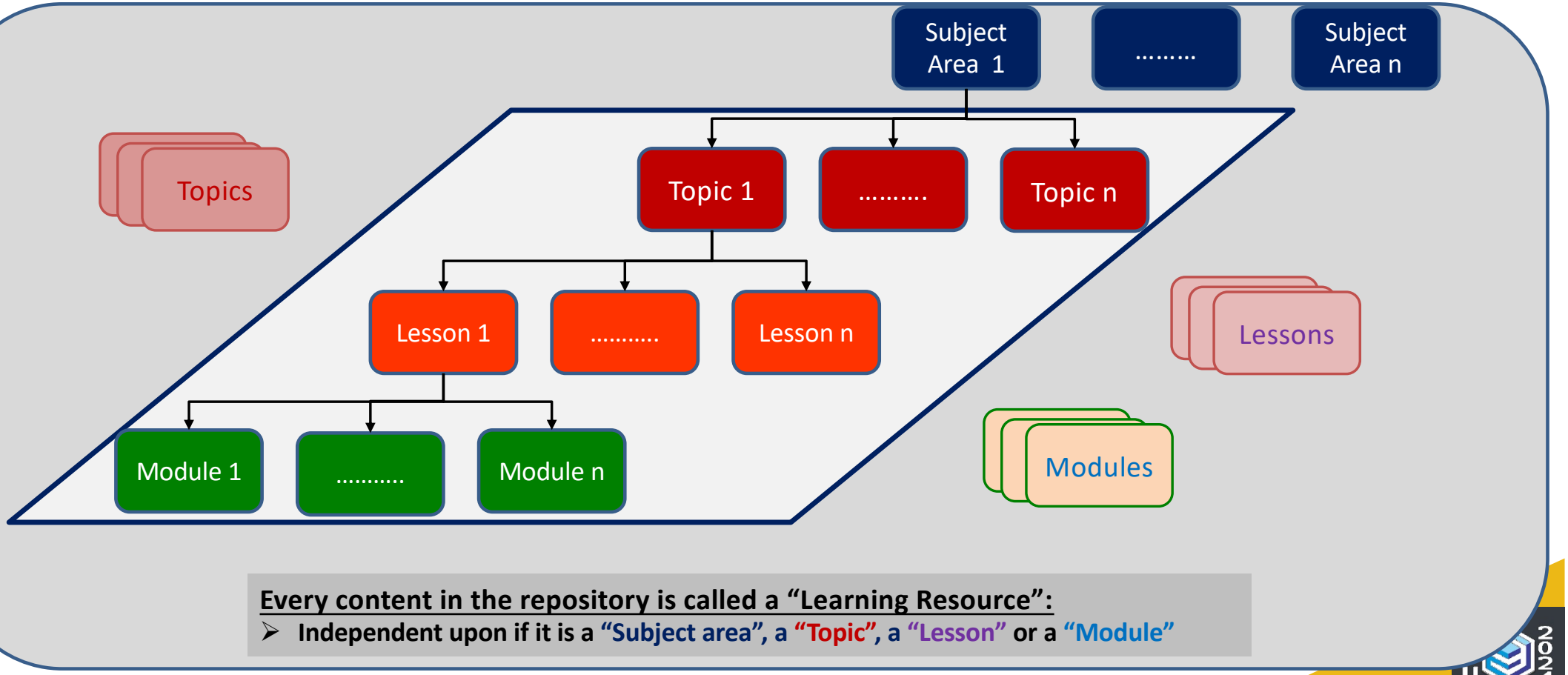
Authoring Tool to co-create Modules between educators



Modules stored in the Repository organized in "folders"

Learnify platform

Structure of the Learning Content

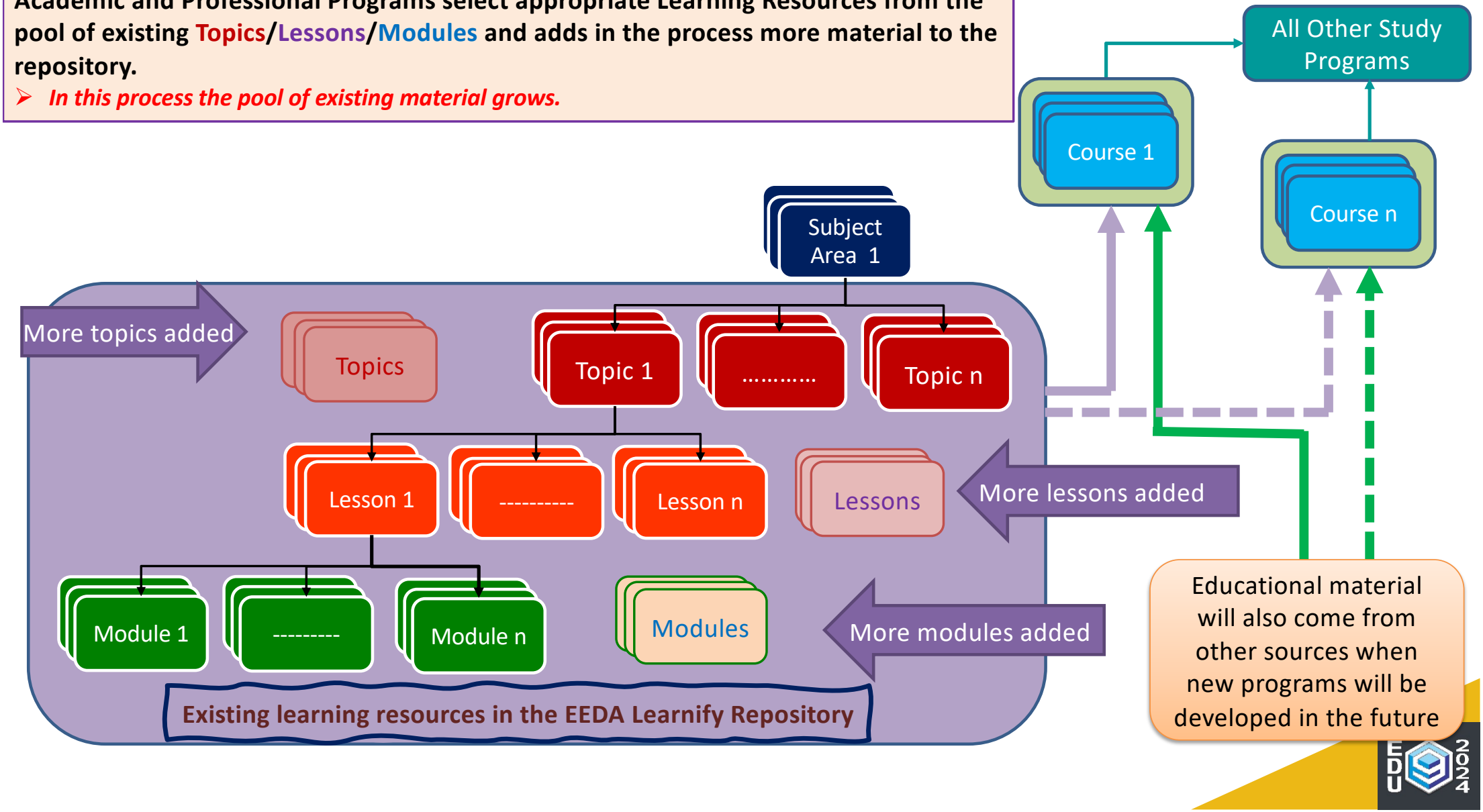


Every content in the repository is called a "Learning Resource":

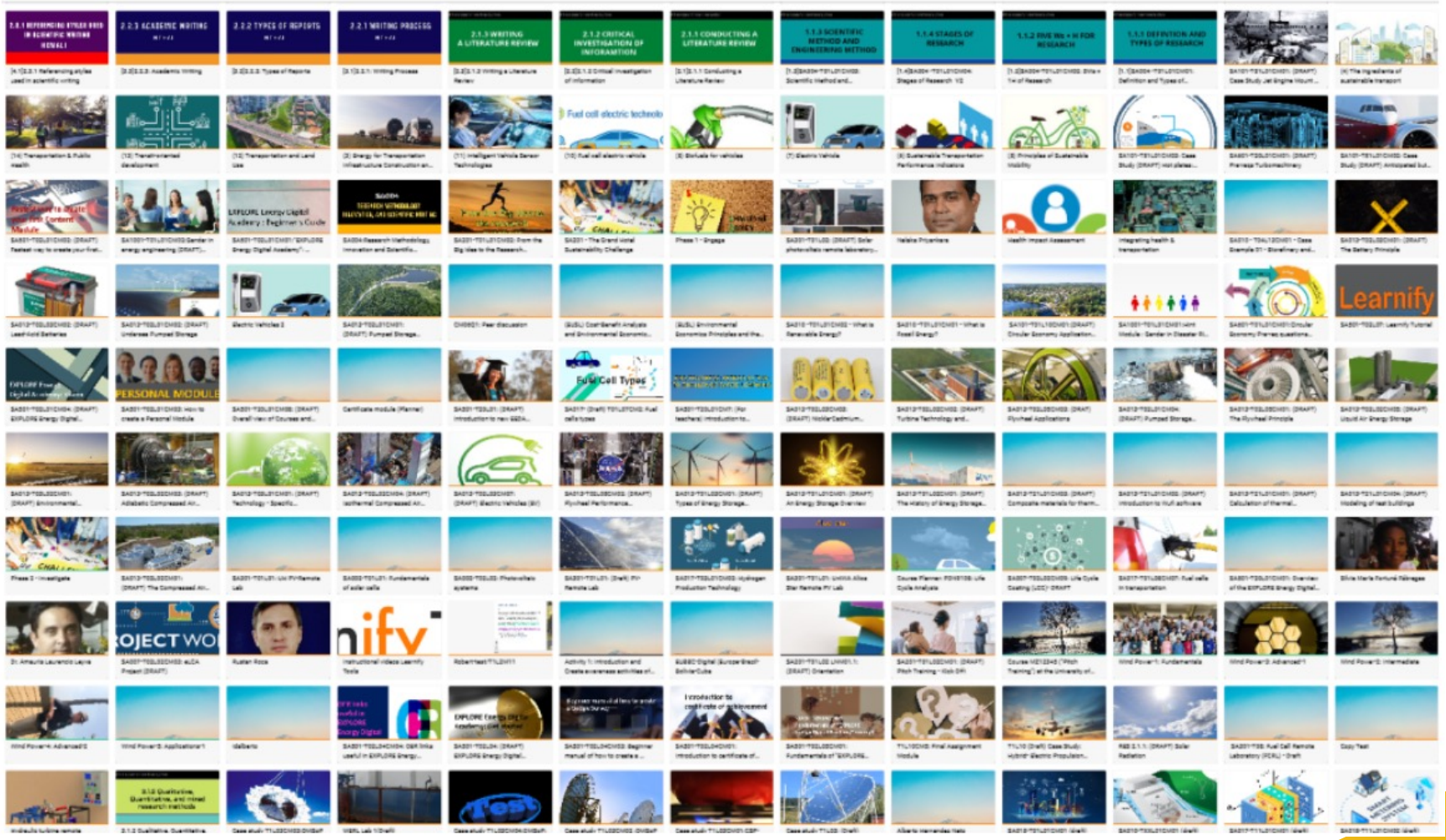
- **Independent upon if it is a "Subject area", a "Topic", a "Lesson" or a "Module"**

Academic and Professional Programs select appropriate Learning Resources from the pool of existing Topics/Lessons/Modules and adds in the process more material to the repository.

- ***In this process the pool of existing material grows.***

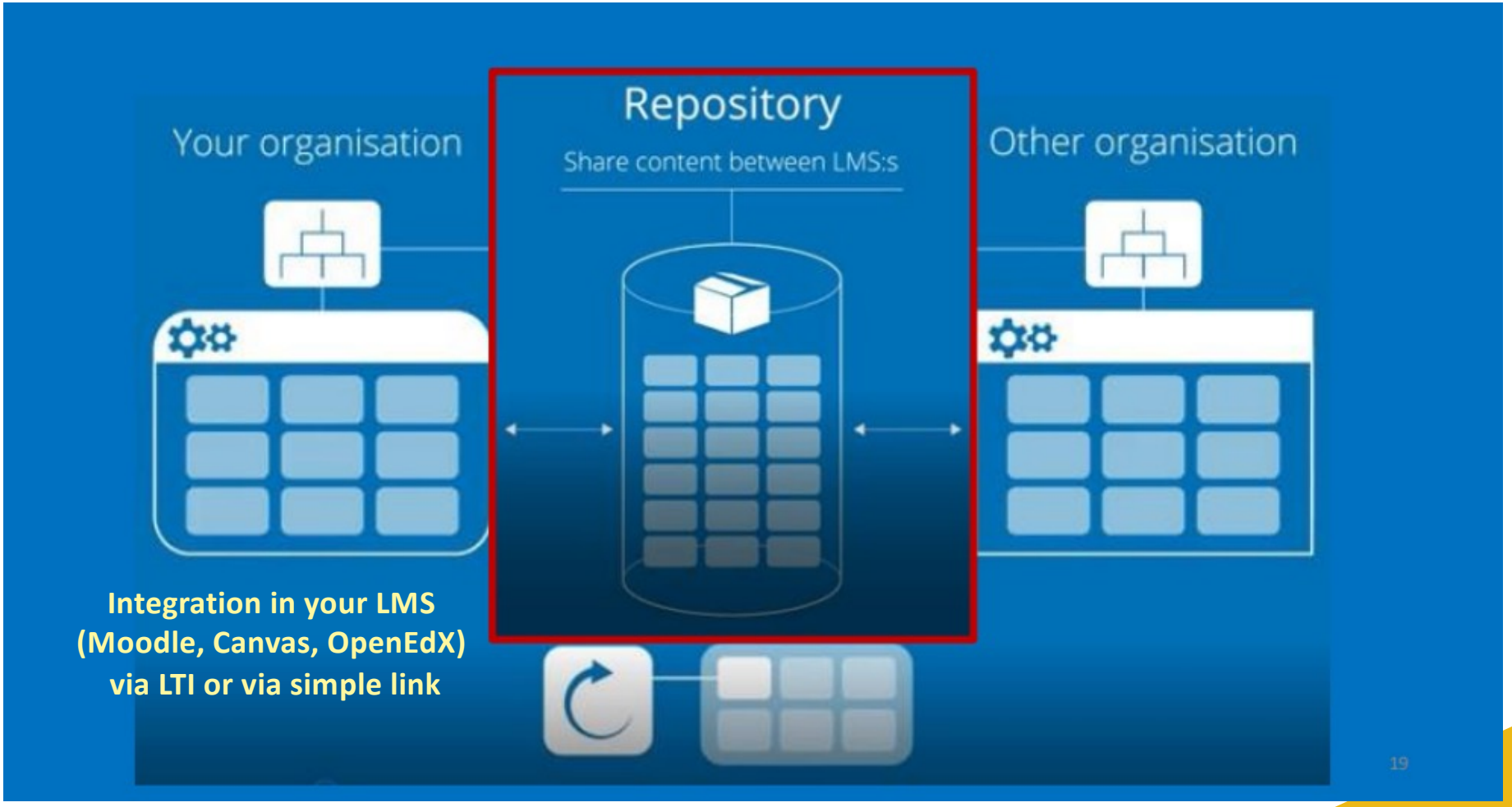


Example of available Modules

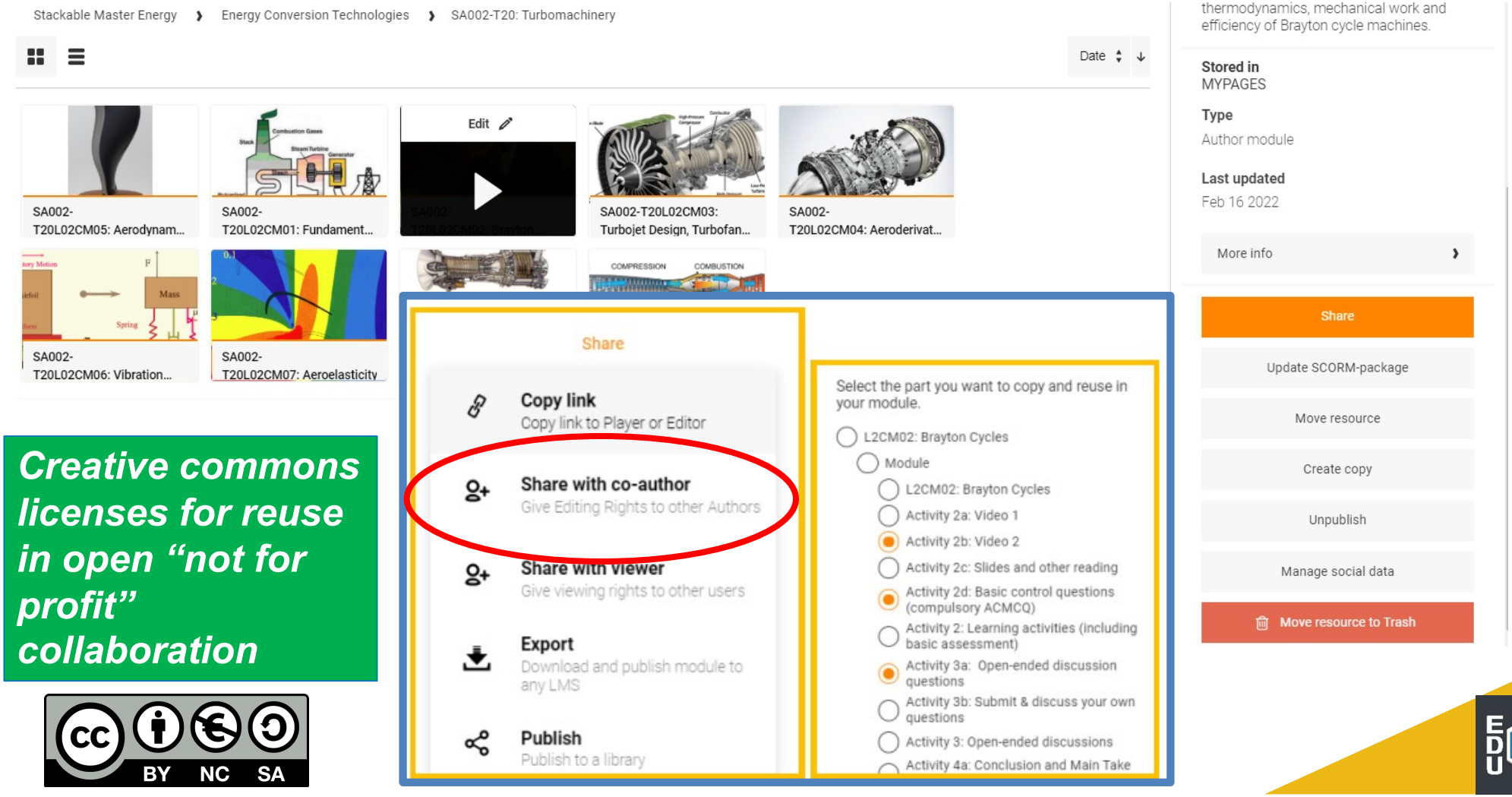


Collaboration between educators

How to use/re-use learning material?



How can educators collaborate?



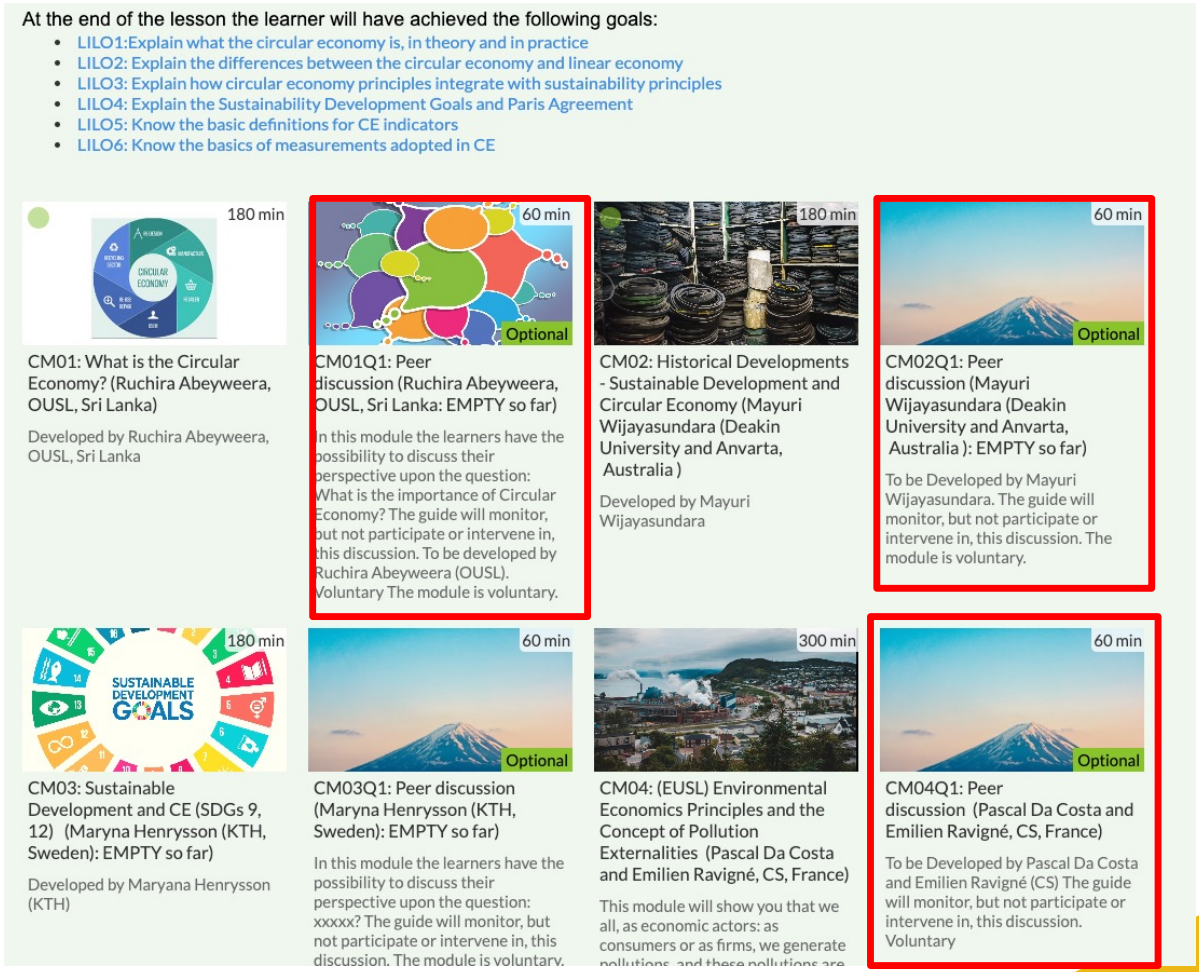
Creative commons licenses for reuse in open "not for profit" collaboration

So, is EEDA about MOOC?

- Massive Open Online Courses (MOOC) (e.g., Coursera, UdaCity, FutureLearn,...) are not designed for co-creation
- EEDA goes much further…
- In EEDA, educators can “build” their own courses using Modules ”lego-wise”
- Students access to Modules in a flipped-classroom perspective
- EEDA enables active learning with classroom time (typically remote) applying concepts, problem-solving and group work.

Applying flipped-classroom: Planner

- A possibility to put different Modules together into a “course”
- Only one link is given to the students for the whole “course”
- We include synchronous sessions (workshops, discussions) with the educator after one or more self-study Module



Example of ”flipped classroom”

Activity 2: Learning activities ding basic assessment)

1

To fully assimilate the learning intended in this module the learner is recommended to listen to the recordings, read the accompanying lecture slides, answer, and reflect upon, the Assessment Questions presented.

- Activity 2a: Video 1
- Activity 2b: Video 2
- Activity 2c: Slides and other reading
- Activity 2d: Basic control questions (compulsory ACMCQ)

Activity 2d: Basic control questions (compulsory ACMCQ)

2

Question 1 of 5:

For a Brayton cycle machine the change in entropy in a component is a function of:

- Temperature ratio, pressure ratio, and gas constants
- The lower calorific value
- The change in enthalpy
- Only the gas constants

ity 3 :Open-ended discussions

3b

activity gives a possibility to reflect upon a set of, for the content module relevant, Open-Ended Questions and discuss these with peers. It is also a preparation for the (for students registered for academic credits: compulsory) live discussion :

The activity consists of:

- reflect upon, and respond to, the presented Open-Ended Questions (OEQ)

- Activity 3a: Open-ended discussion questions
- Activity 3b: Submit & discuss your own questions

3a

This sequence is locked

You have to complete the previous sections.

Bob Kielb

4

Professor of the Practice in the nt of Mechanical Engineering & Materials Science

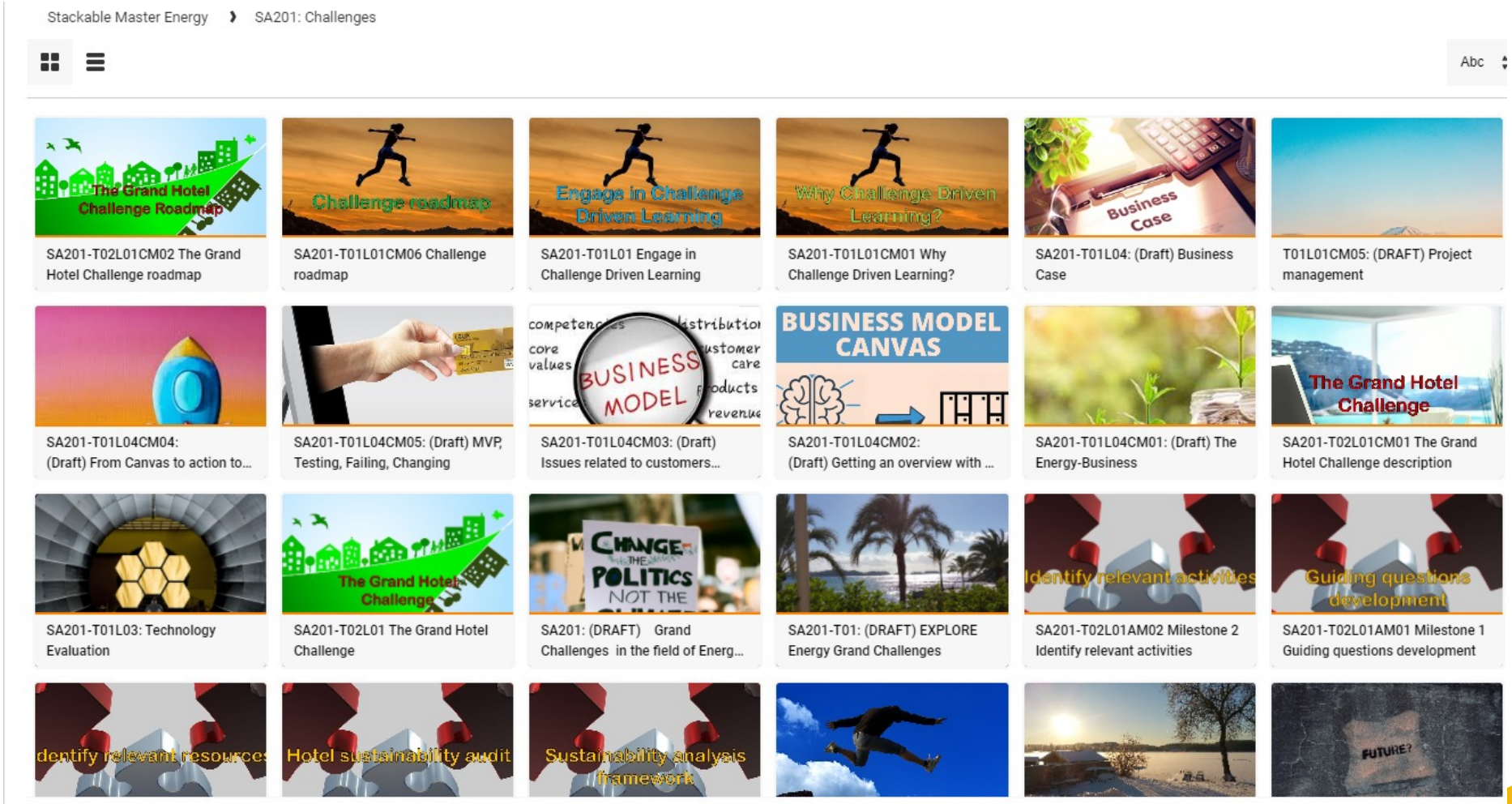
Robert Kielb has over 45 years academic, industrial and government research laboratory experience in turbomachinery propulsion. This consists of 8 years with the U. S. Air Force, 10 years with NASA Lewis Research Cente , and 12 years with GE Aircraft Engines as Manager of Aeromechanics Technology. He has also been an Affil ted

5

Challenge-Based Learning (CBL)

- Active Learning methodology, involving "21st century skills"
- Engaging students in real-world problems and challenges that require them to research, develop, and implement solutions
- Students work in groups, milestone meetings
- The outcome is not pre-determined
- EEDA Repository contains Modules for students and for educators!!

Challenge-Based Learning (CBL)

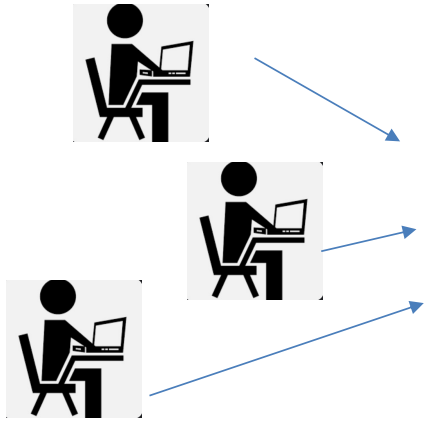


First Challenge
In Sri Lanka
4 Universities
150 students
“Sustainable Hotel Challenge”

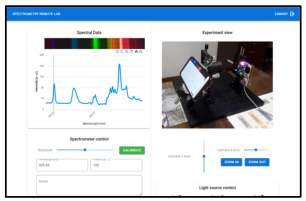
EEDA Remote Laboratories

- Optimizing lab resources globally
- Share labs through remote access
- Key element to link theory and practice
- Technically not trivial to “turn” a lab for remote control

What are Remote Laboratories ?

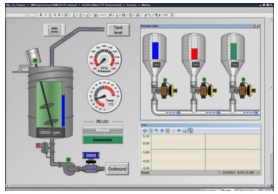


Remote students



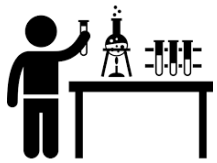
Remote Interface

?



Control hardware and software

Lab equipment



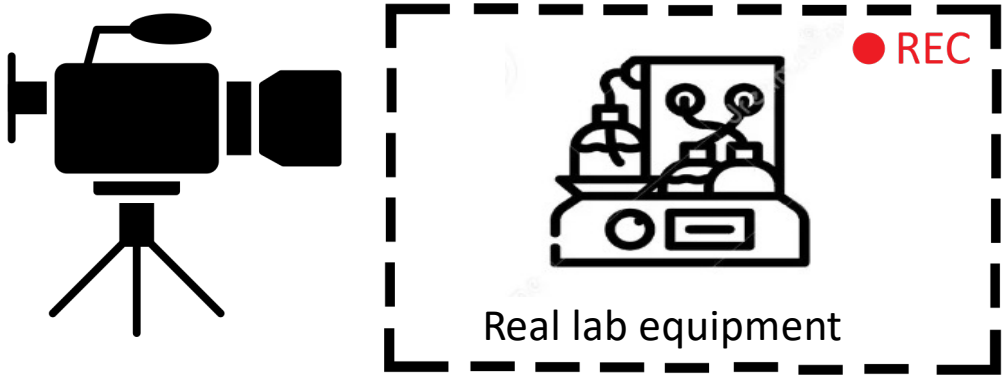
Types of Remote Labs

- **Ultra-Concurrent Labs**

Real lab equipment

Types of Remote Labs

- **Ultra-Concurrent Labs**



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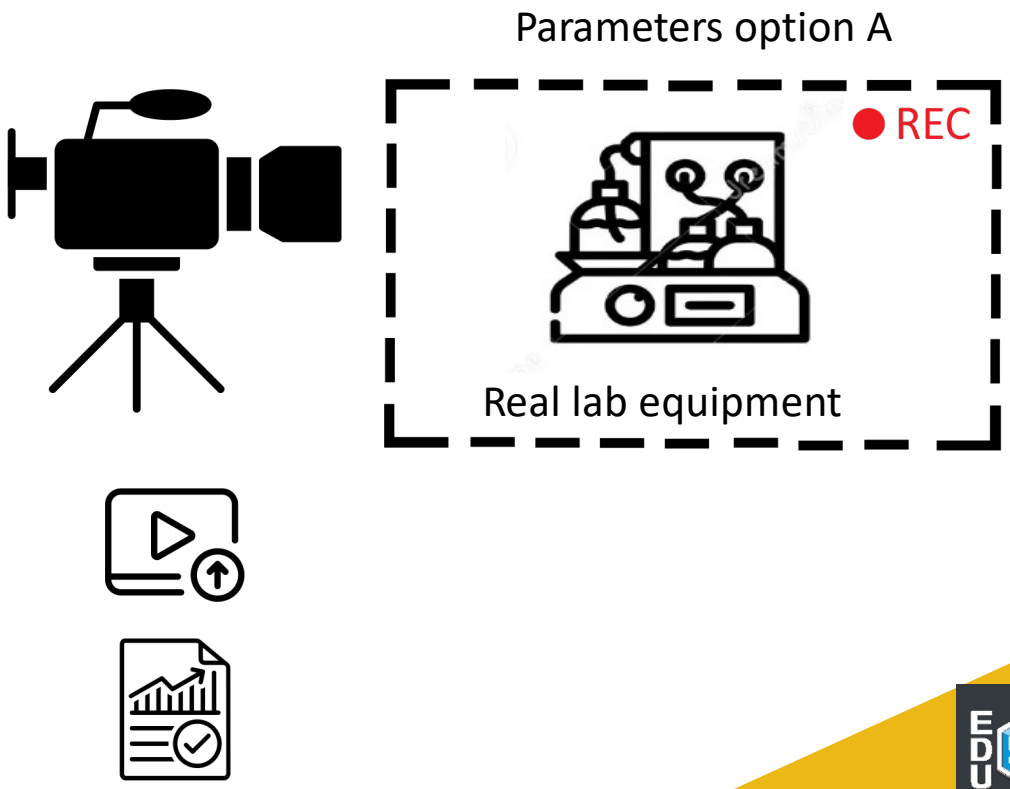

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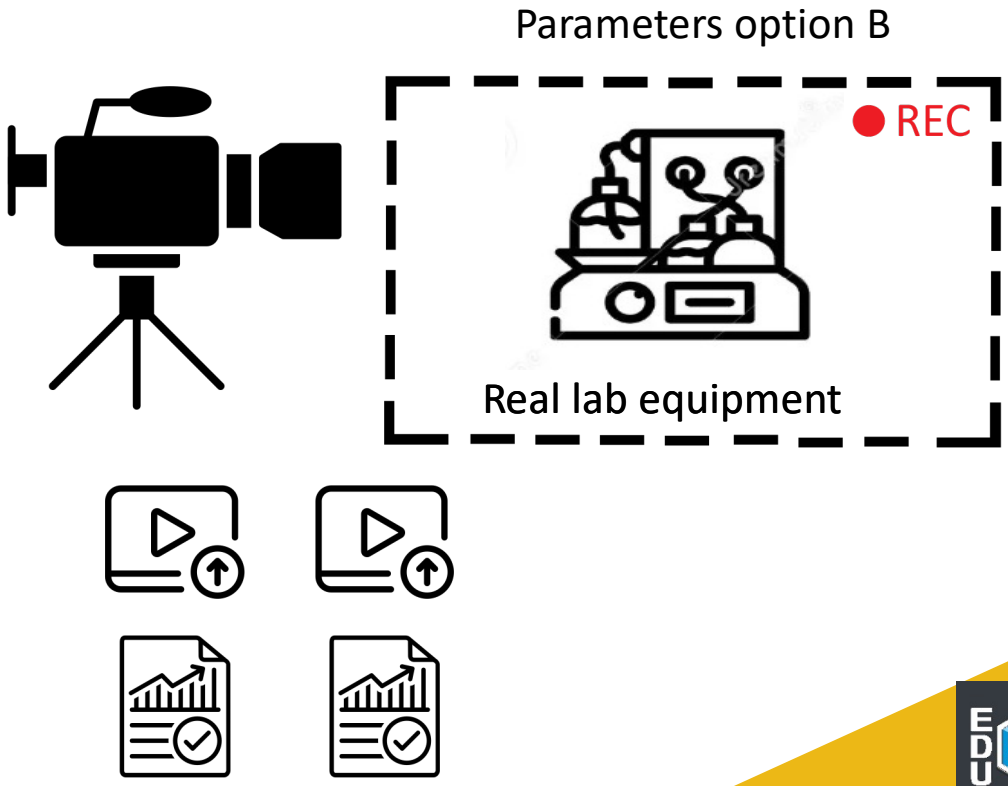

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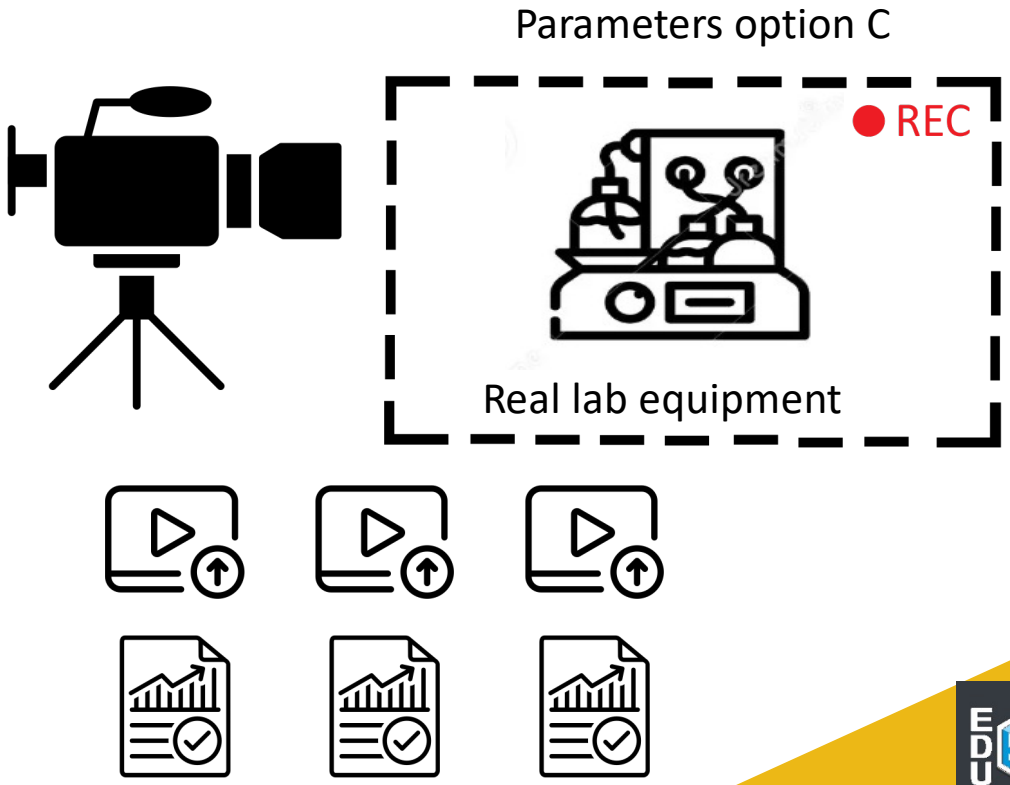

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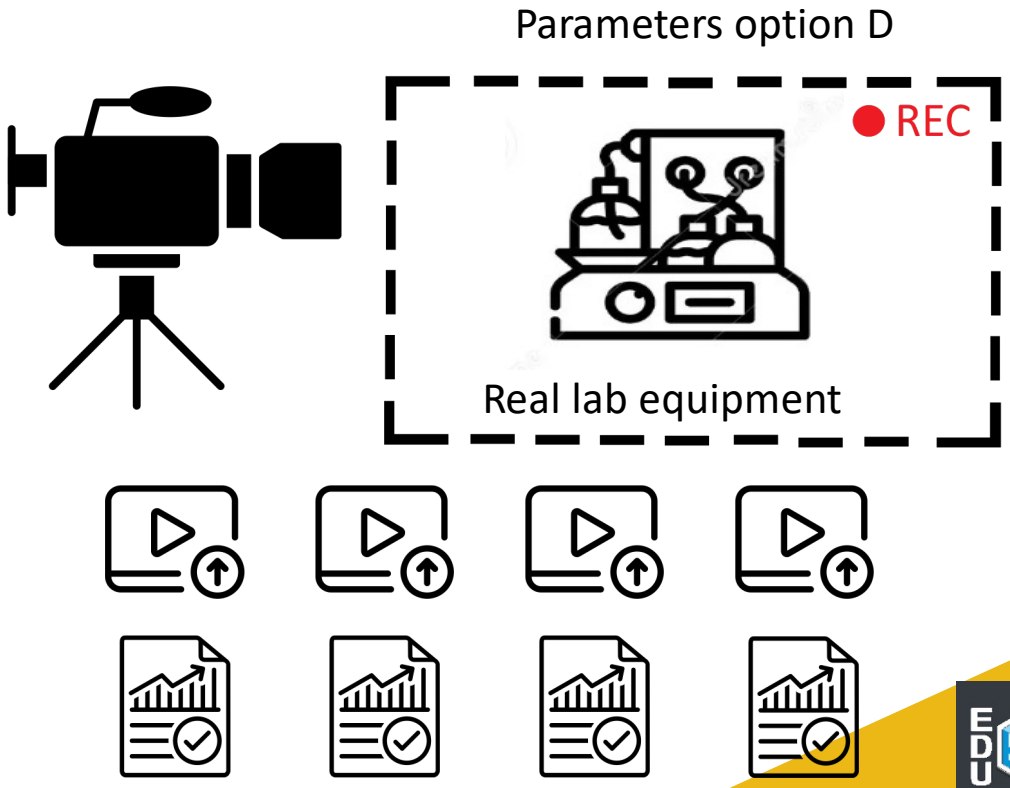

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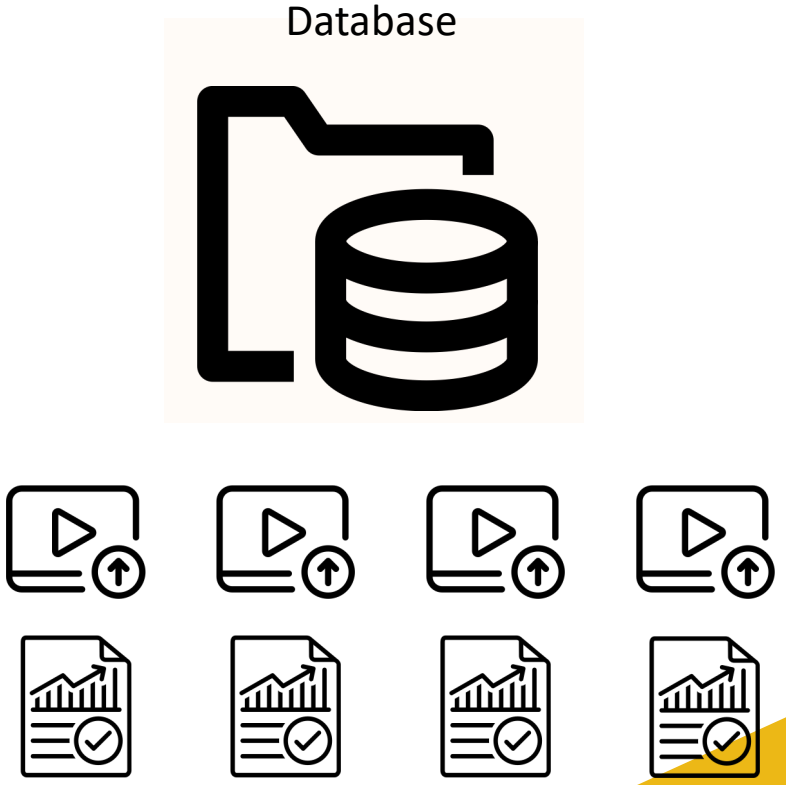

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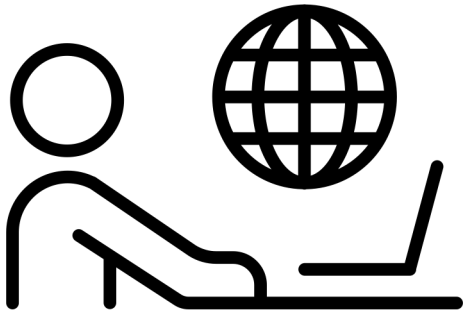

Web interface

Types of Remote Labs

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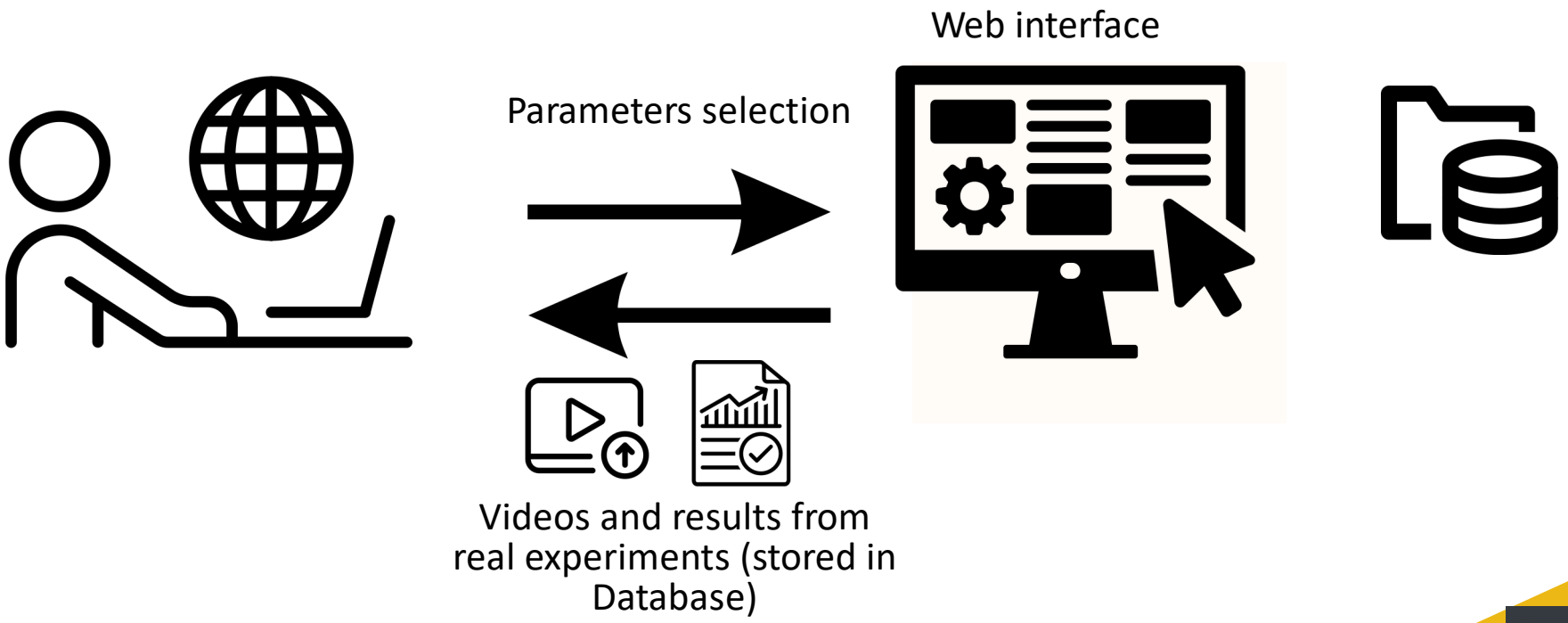

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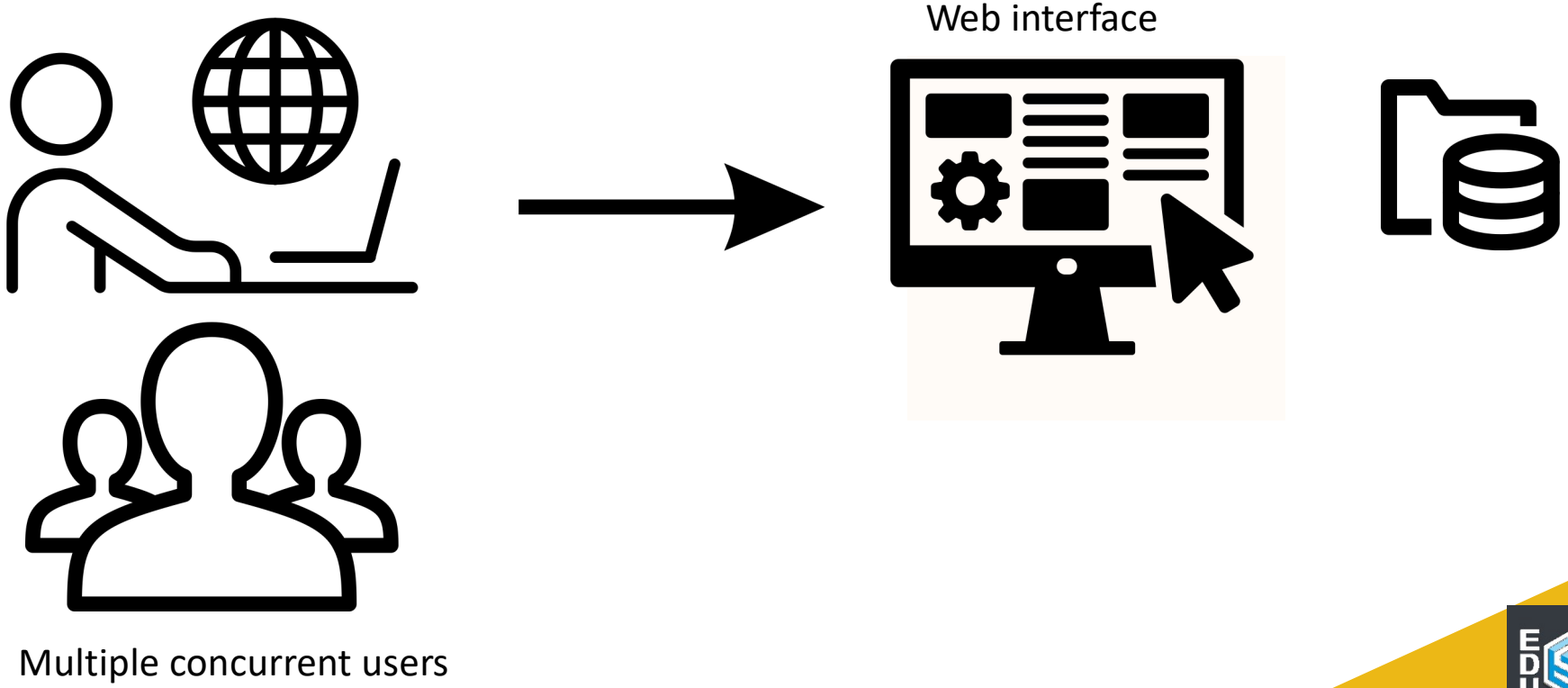


Types of Remote Labs

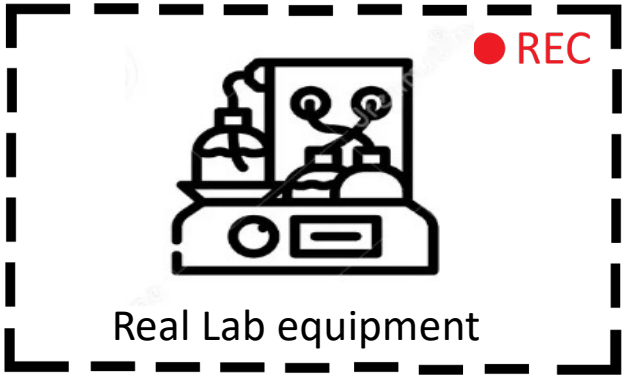
- **Real-time Labs**

Real Lab equipment

Types of Remote Labs

- **Real-time Labs**

Live streaming



Real Lab equipment

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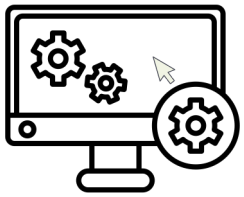
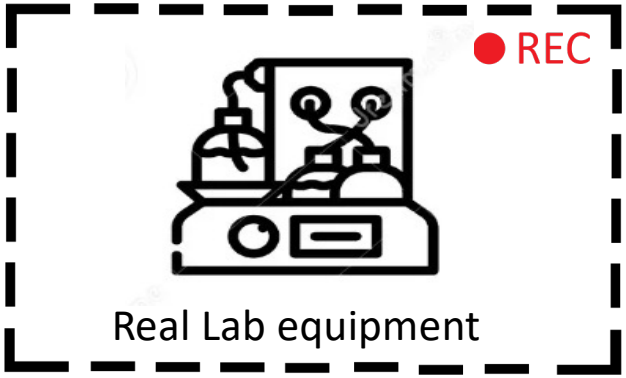


Remote control

Live streaming



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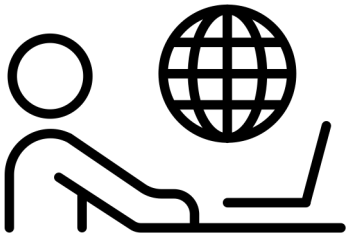
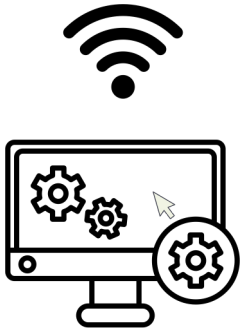


Only one student!!



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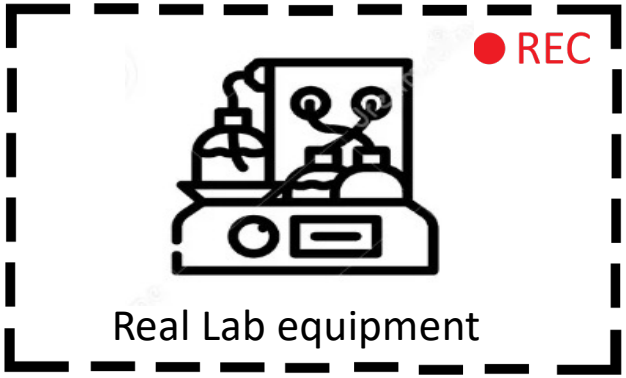

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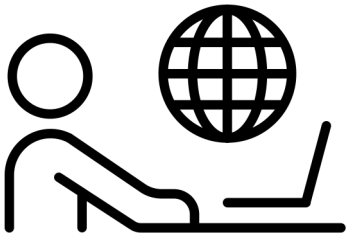

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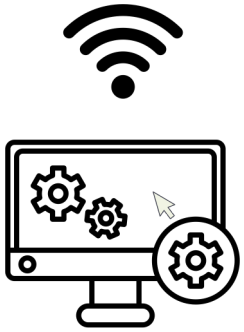

Remote control

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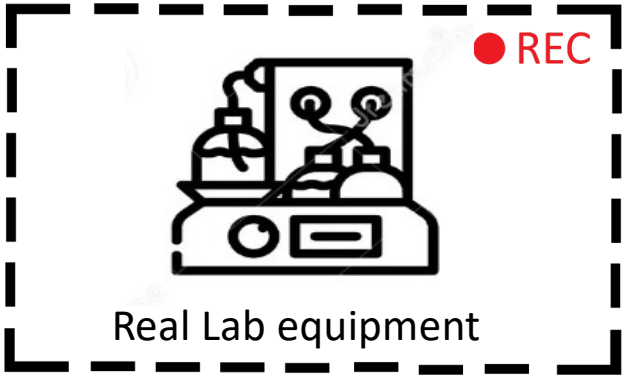
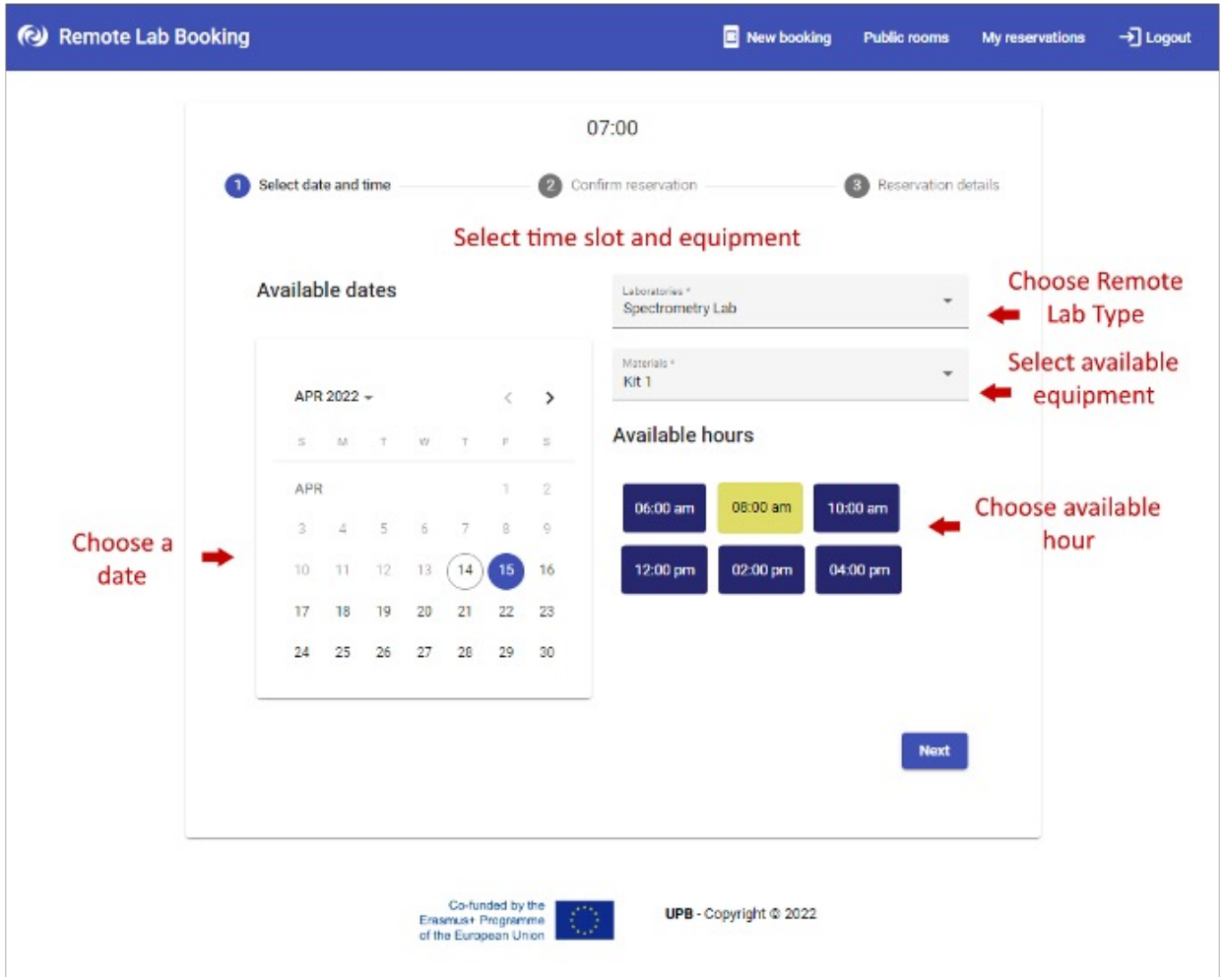


Real Lab equipment

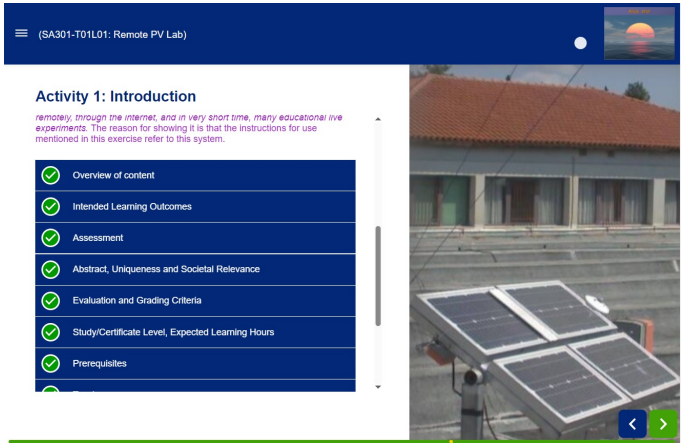
Requires a Booking System for exclusive session (avoids interferences)

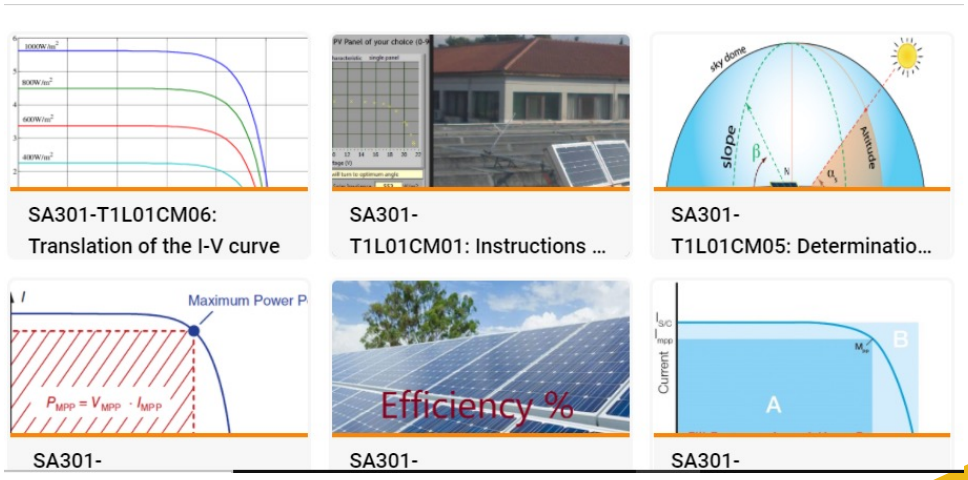
Generic Remote Lab Booking System



Remote Laboratories in EEDA

- A set of 20+ Remote Labs in energy are under preparation (7 up and running presently)
- Will allow users from anywhere to perform lab experiments
- Modules available for students and educators





EEDA Remote Labs Portal

New Remote Lab
UPB

Course: Energy
Instructor: Alex Villazon
Description: Energy Remote Lab at KTH

NOT AVAILABLE MORE INFO >>

Spectrometry Remote Lab
Universidad Privada Boliviana

Course: Optics
Instructor: Omar Ormachea
Description: Low-cost Spectrometry Remote Lab

NOT AVAILABLE MORE INFO >>

Solar Remote Lab
Universidad Privada Boliviana

Course: Renewable Energy
Instructor: PhD. Alex Villazón
Description: Remote Solar Lab for testing with a solar panel

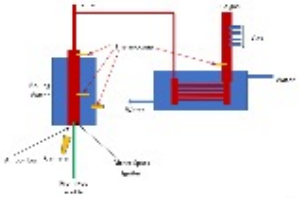
AVAILABLE MORE INFO >>

Wave Energy Laboratory
University of Peradeniya

Course: Ocean Energy
Instructor: Dr. Kamalanath Samarakoon
Description: Wave Energy Lab

NOT AVAILABLE MORE INFO >>

Combustion Remote Laboratory
University of Moratuwa



Course: Master of Science in Energy for Circular Economy
Instructor: Mahinsasa Narayana
Description: Combustion is a chemical process between substances, usually

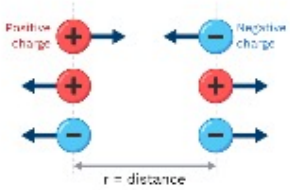
NOT AVAILABLE MORE INFO >>

Wind Energy Remote Online Lab
University of Ruhuna

Course: Renewable Energy Technologies
Instructor: Dr. K. Jayawickrama C. Kumara
Description: WEROL and University of Ruhuna funded by EU Erasmus+ EUSL EnergyProject

NOT AVAILABLE MORE INFO >>

Coulomb Lab
Universidad Privada Boliviana



Course: Physics
Instructor: Omar Ormachea
Description: The Coulombs Law remote lab is an interactive online experiment designed to demonstrate and explore the principles of

NOT AVAILABLE MORE INFO >>

Wind Energy
Universidad Central "Marta Abreu" de las Villas, Cuba

Course: How to use the wind energy unit remote lab
Instructor: Leonardo Agustín Hernández Pérez
Description: The Wind Energy Unit, "EEE", contains an aerogenerator, in laboratory-scale,

NOT AVAILABLE MORE INFO >>

Steam Turbine
Universidad Central "Marta Abreu de las Villas"

Course: How to use Steam Turbine Remote Lab
Instructor: Leonardo Agustín Hernández Pérez
Description: This Lab is based in The Computer Controlled Steam Turbine, "TTVC".

NOT AVAILABLE MORE INFO >>

Solar Energy
Universidad Central "Marta Abreu" de las Villas

Course: How tu use EE-KIT2 Unit with ESR Grid Simulator
Instructor: Leonardo Agustín Hernández Pérez
Description: The EE-KIT2 unit has been designed to demonstrate the operation of an

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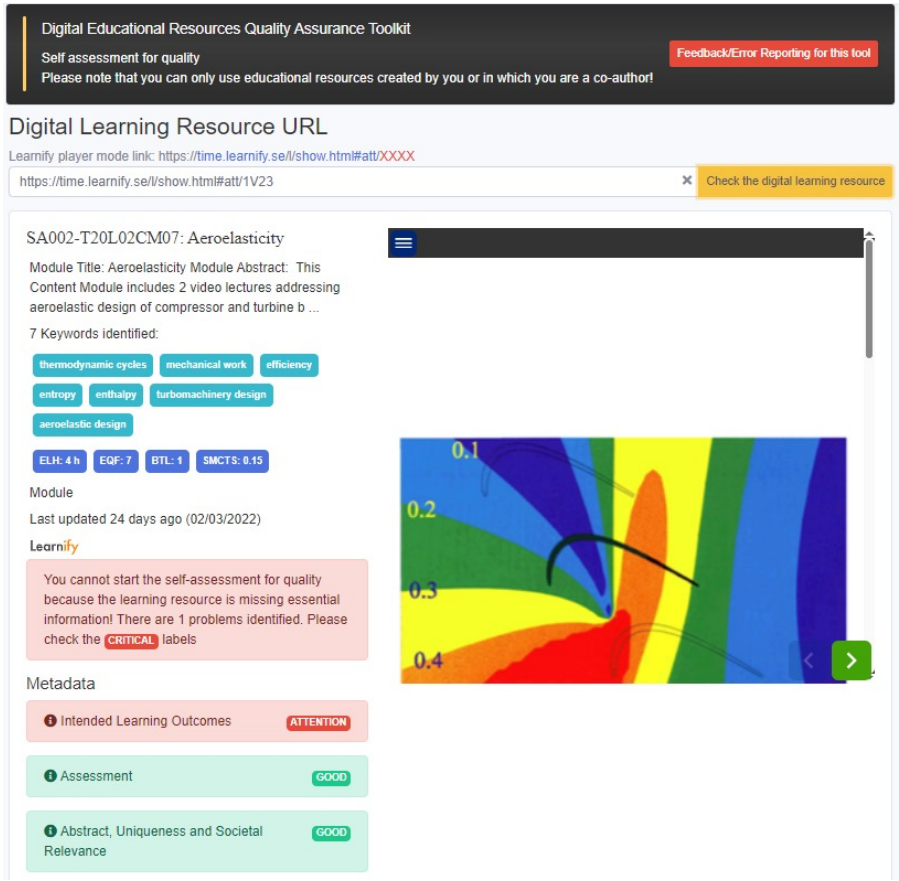
What about Quality of learning material

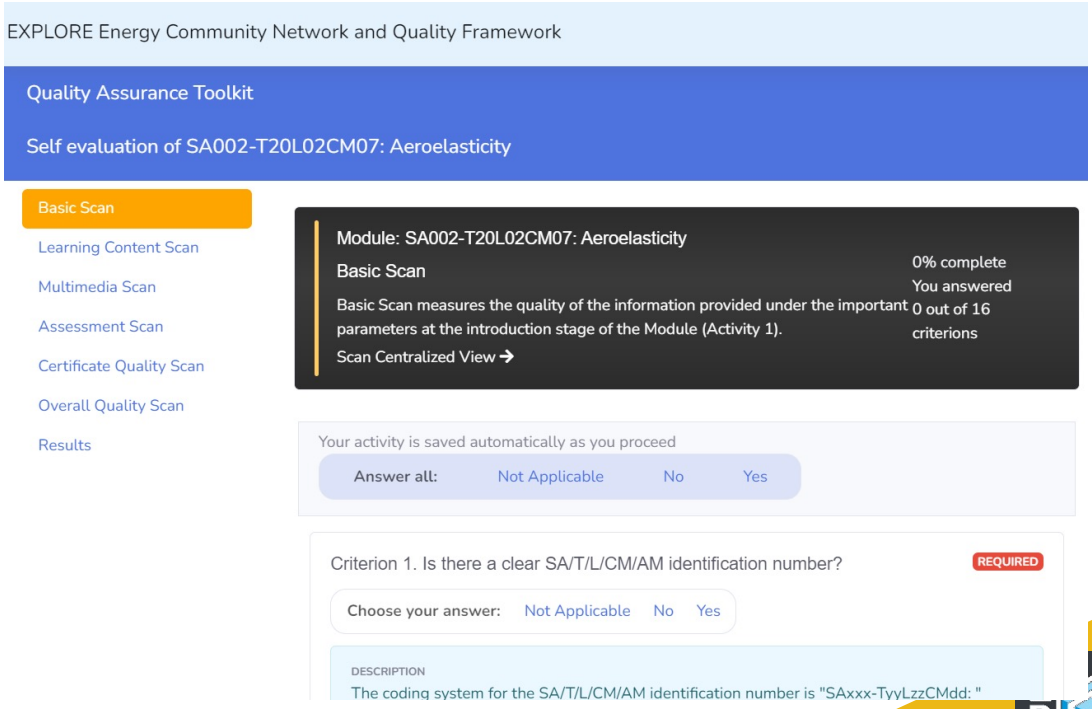
- Each Module goes through a Quality Improvement Process (QIP)
  - Various “scans” to ensure basic content (e.g., author’s information, Intended Learning Outcomes, number of ELHs, keywords, etc.)
  - Scans on the quality of the content
- Review process in two phases
  - Self-review by the author of the Module (Basic badge)
  - Peer-review by educators from the EEDA network (Bronze, .. Gold, Diamond badge)

EEDA QIP Tool

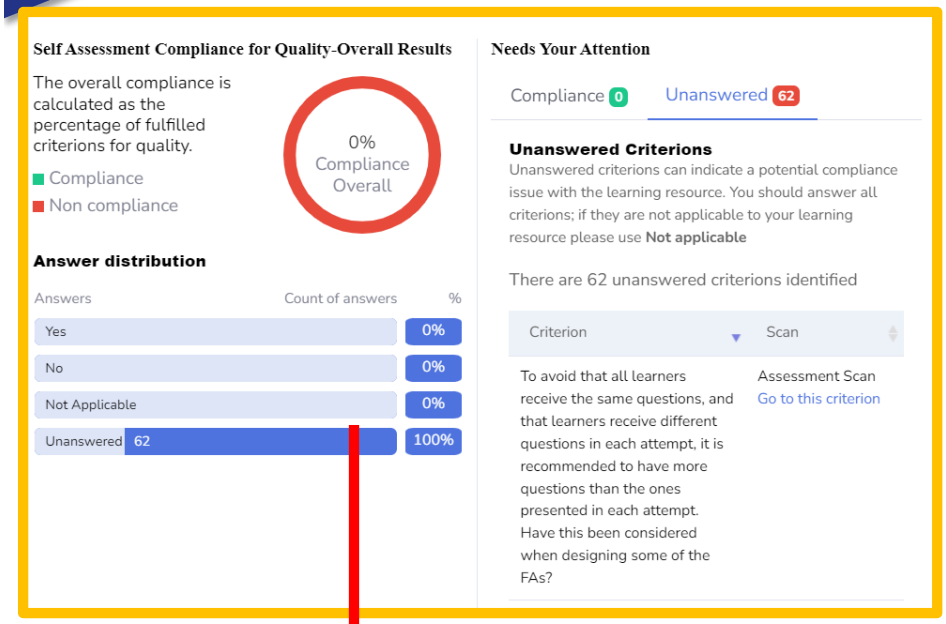
Self-review & Peer-review Based upon EIT Label Handbook adapted to needs of emerging regions

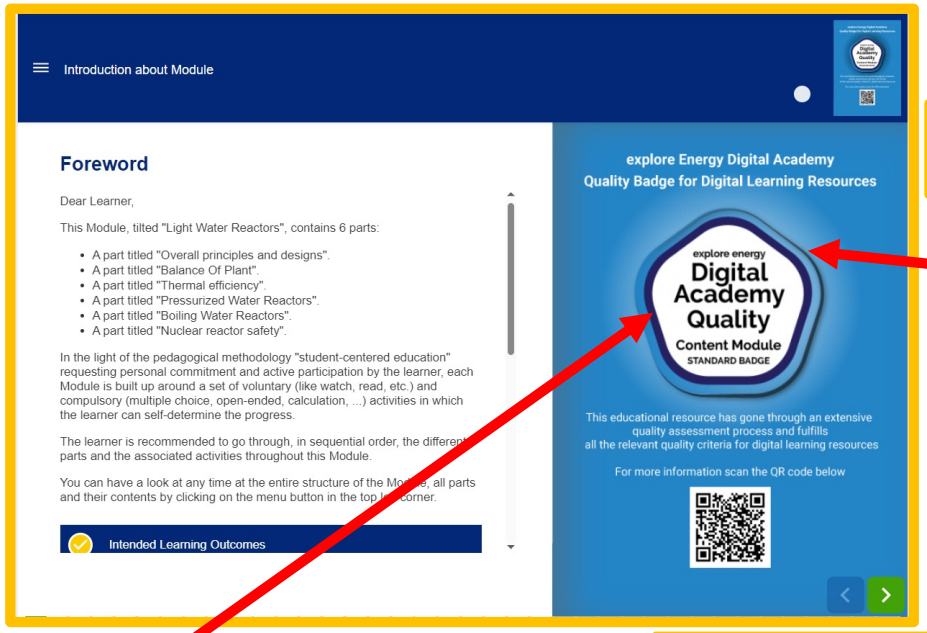
(European Institute of Innovation and Technology)



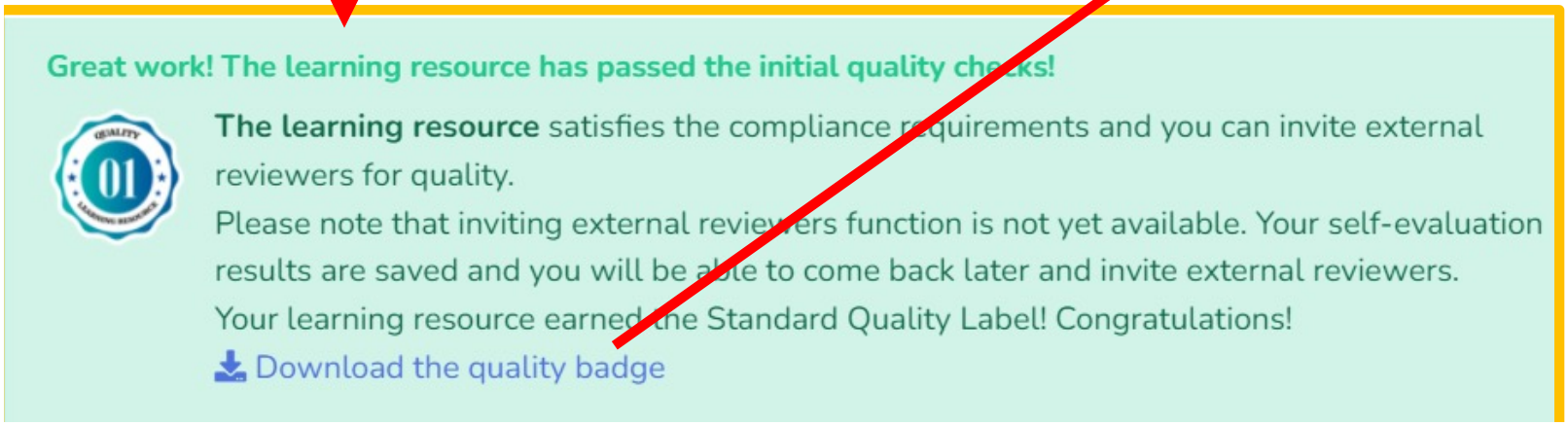


QIP: Results and badges





After peer-review



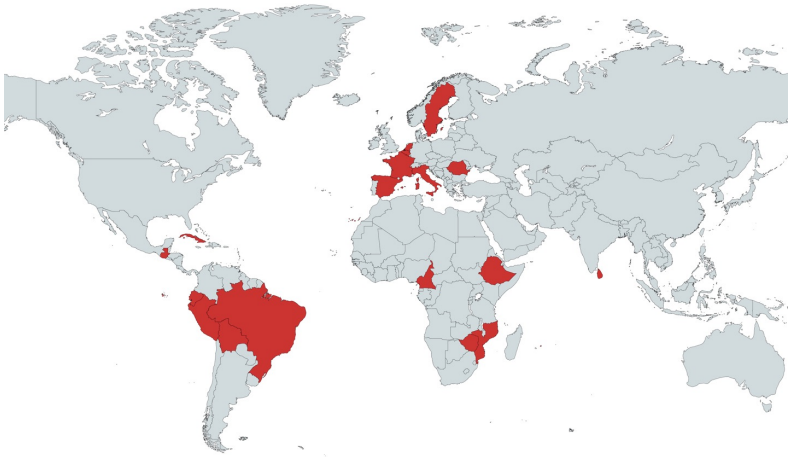
- The badge is accessible to everyone and contains all the necessary “Meta-data” for quality.
- Next step: Include feedback from students

The EEDA Family

EU-BEGP

EUSL ENERGY 2020-2023

EUBBC Digital



EXPLORE Energy Digital Academy

EUZW

EDU ABCM

Joining forces to create a global educator-to-educator network
to modernize student-centered digital education

Co-funded by the
Erasmus+ Programme
of the European Union

Conclusion

- A framework for modernizing digital education through collaboration and active learning (pilot in Energy)
- Built up around “small learning resources” (Modules)
- Educators can co-create, use, re-use, modify, translate the available learning material to build courses/programs
- Active learning methodologies as the core of the framework (flipped-classroom, challenge-based learning, and remote labs)
- Peer-review is key to ensure quality
- Focus on learning, not on teaching

UPB

EU-BEGP

Cofinanciado por el programa Erasmus+ de la Unión Europea

EU-BEGP Partners

- 3 Universities in Bolivia (UPB, UMSS y UMSA)
- 2 Universities in Ecuador (ESPOL, EPN)
- 2 Universities in Guatemala (GALILEO, USPG)
- 2 Universities in Peru (UNI y PUCP)
- 2 Universities in France and Spain (UPC y U. Bordeaux)

EDU 2024

Thank you!
Q&A

- Contact: Prof. Alex Villazón (avillazon@upb.edu)
- EEDA coordinator: Prof. em. Torsten Fransson (fransson.kth@outlook.com)
  - Soon released: https://eeda.academy