

Facilitating teacher online collaboration in the development of media resources for the classroom

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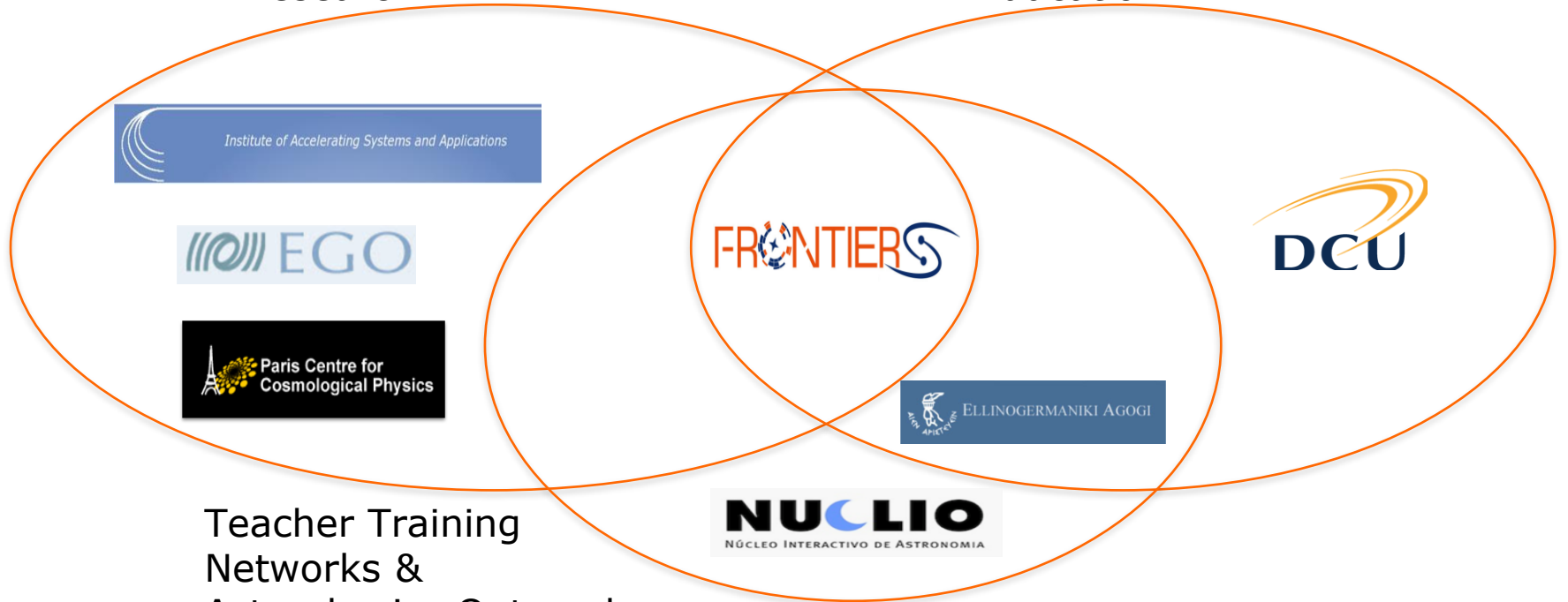


IASA



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Teacher Training
Networks &
Astrophysics Outreach



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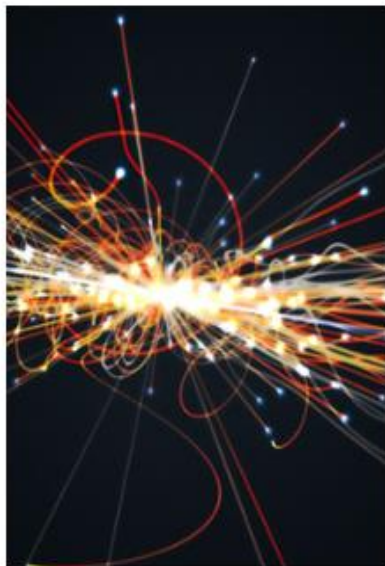
This project is funded by the European Union.

Challenges

- 20-30% of physics teachers have not studied physics at university (Price, 2019; Caldis, 2017; Banilower, Trygstad & Smith, 2015).
- Many teachers avoid the topic of high-energy physics in their classes due to deficiency in their own education on the topic (Araujo and Dias, 2020).
- Teachers facing the challenge of integrating pedagogical practices, digital tools and curricular resources with limited access to professional development opportunity, need additional online professional development support (Hollebrands and Lee, 2020)

Frontiers Educational Resources

HOME • FRONTIERS EDUCATIONAL RESOURCES



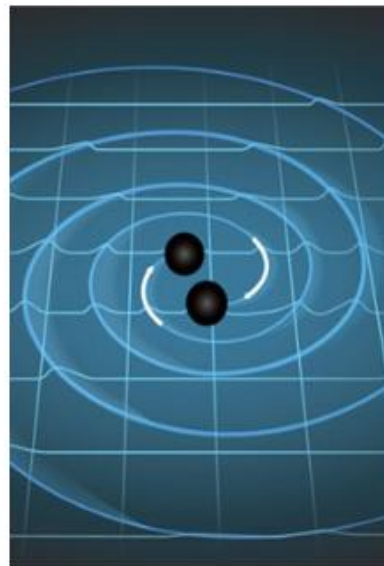
High Energy Physics



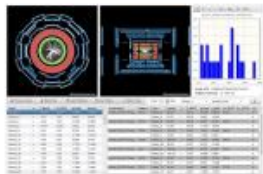
Astroparticle Physics



Astrophysics



Gravitational Wave
Astronomy



Search for the Z and Higgs bosons

VIEW THE DEMONSTRATOR



Gravitational Wave Noise Hunting

VIEW THE DEMONSTRATOR



Finding black-holes in a chirp

VIEW THE DEMONSTRATOR



Exploring the Sun Does the Sun Rotate?

VIEW THE DEMONSTRATOR



Exploring the Sun: The differential rotation of the Sun

VIEW THE DEMONSTRATOR



Discovering and building a Michelson interferometer

VIEW THE DEMONSTRATOR



Measuring the recess velocity of distant galaxies



Black Holes in my Classroom



Build your own Cloud Chamber



How to accelerate particles



Mass-Energy equivalence



Relativistic Muons and Time Dilation



DISCOVERING ALIEN WORLDS - THE DISCOVERY OF AN EXOPLANET

ORIENTING & ASKING
QUESTIONS

HYPOTHESIS GENERATION & DESIGN

PLANNING & INVESTIGATION

ANALYSIS & INTERPRETATION

CONCLUSION & EVALUATION

 LISTEN CONTENT

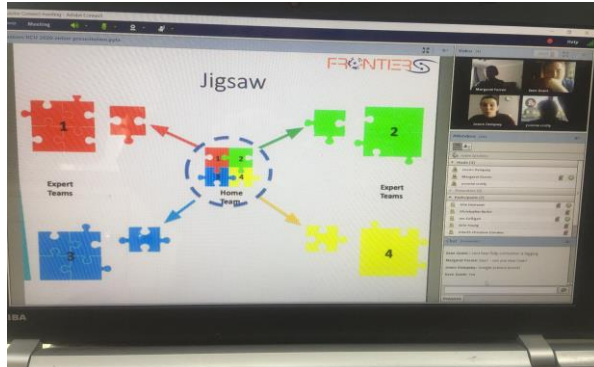
Exoplanets

You certainly know that our planet orbits a star, the Sun, and that there are other planets revolving around the Sun in our Solar System.

The Sun is a small star formed 4.5 billion years ago from the gravitational collapse of a molecular cloud. The leftovers formed a disc-shaped cloud of gas and dust surrounding the Sun, out of which the planets and other smaller bodies of the solar system were formed. How they formed is still not clear and we find different theories to explain how it happened.

1. Orienting and asking questions
2. Hypothesis generation and design
3. Planning and investigation
4. Analysis and interpretation
5. Conclusion and evaluation

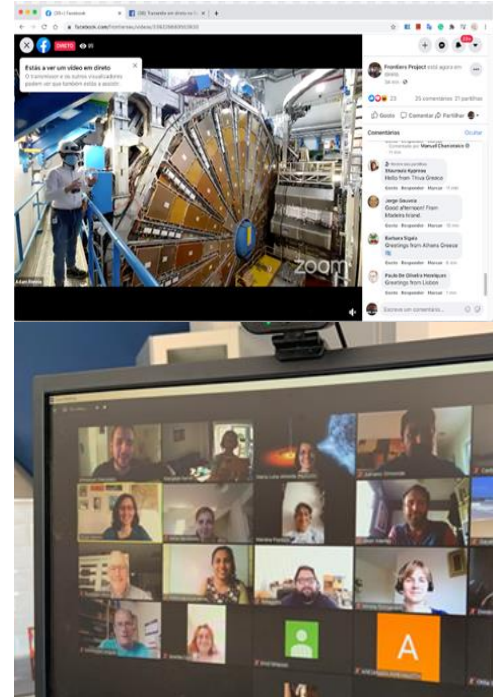
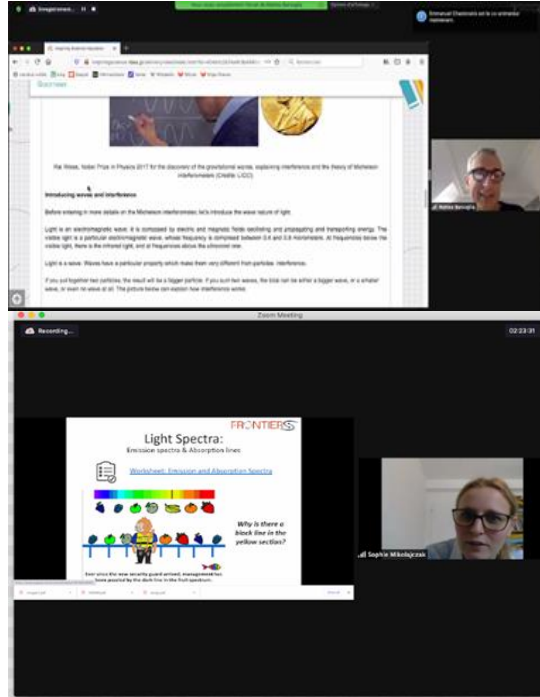
Local workshops held F-2-F & online due to pandemic.



3 one-week International summer and winter schools online due to pandemic.

277 participants fully completed the International e-Schools with many others joining for virtual visits hosted as part of the e-School events.

There are now 70 teachers actively enrolled in the FRONTIERS Google Classroom.





Took place online

Pandemic

Wider Scope

India

Reach out beyond our consortium's countries

South America

Pakistan

Columbia

Bangladesh

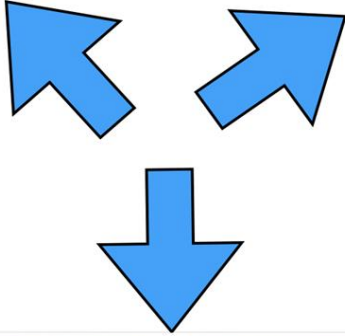
Brazil

Sri Lanka

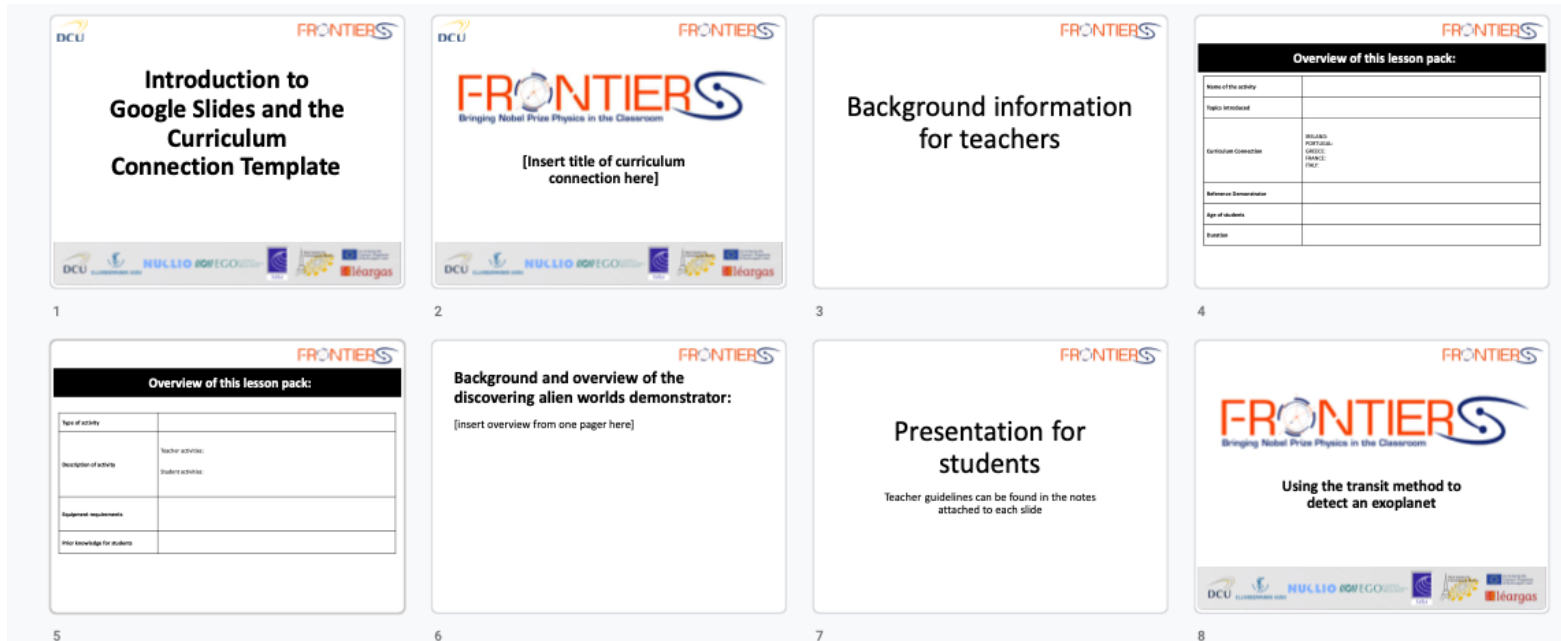
Europe Erasmus +

Chilli

Argentina



Google Classroom/Slides - teachers were able to collaborate with teachers in the development of lesson plans based on the demonstrators.



1

Introduction to Google Slides and the Curriculum Connection Template

2

FRONTIERS
Bringing Nobel Prize Physics in the Classroom

[Insert title of curriculum connection here]

3

Background information for teachers

4

Overview of this lesson pack:

Name of the activity	
Topic introduced	
Curriculum Connection	RELATED: PHYSICAL GEOSCIENCE AEROSPACE PARTICLES
Reference Demonstrator	
Age of students	
Duration	

5

Overview of this lesson pack:

Name of activity	
Description of activity	Teacher activities: Student activities:
Equipment requirements	
Prior knowledge for students	

6

Background and overview of the discovering alien worlds demonstrator:

[insert overview from one pager here]

7

Presentation for students

Teacher guidelines can be found in the notes attached to each slide

8

FRONTIERS
Bringing Nobel Prize Physics in the Classroom

Using the transit method to detect an exoplanet

Group activity for teachers for the e-Winter school

- Based on one of the Frontiers Online resources/Demonstrators create a lesson plan and class resources in working groups of 3 or 4.
- Working groups use Google Slides to collaboratively develop lesson plan and class resources.
- The resource should be suitable for a 1 hour class.
- Expert mentors available during the e-Winter school.

Lesson Plan

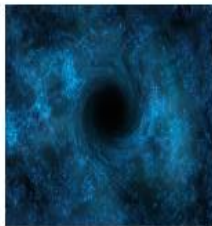
Name of the activity	
Topics introduced	
Curriculum Connection	
Reference Demonstrator	
Age of students	
Duration	

Lesson Plan

Type of activity	
Description of activity	
Equipment requirements	
Prior knowledge for students	

BLACK HOLES

Collaborators: Stavroula Pierou & Fotinei Liğara



FRONTIERS
Engaging Active First Physics in the Classroom



Name of the activity	Black hole M87: "An image that made history"
Topics introduced	<ul style="list-style-type: none"> How spacetime is curved What a black hole is How black holes are created First-time man took image from a black hole – M87 Graph analysis
Reference Demonstrator	Black holes in my school
Curriculum Connection	Gravity, density, astronomy, graph analysis
Age of students	13 – 16 years
Duration	3-4 hours
Learning Intentions	<ul style="list-style-type: none"> Define a black hole Describe basic characteristics of black holes Explain an eclipsing binary system Form conclusions about a binary system from a light graph

Type of activity	"hands on" and "hands on" approaches: material handling, critical thinking, problem solving
Description of activity	<p>Teacher activities:</p> <ul style="list-style-type: none"> Present Powerpoint presentation explaining scientific concepts, such as, black holes and spacetime Provide worksheet to check understanding Prepare worksheet for group work activity Monitor students progress through activity <p>Student activities:</p> <ul style="list-style-type: none"> Watch teacher's PowerPoint Watch relevant YouTube videos chosen by the teacher Complete the worksheet Work in groups to determine the binary system and potential black hole
Equipment requirements	<ul style="list-style-type: none"> Projector, pc with internet connection for ppt presentations and YouTube videos and a printer Email or messenger accounts to send images between working groups Worksheets for each person/group Black hole model - foam ball, metallic ring, cardboard paper, glue, tripod, printer, scissors
Prior knowledge for students	<ul style="list-style-type: none"> Concept of gravity and density Optical phenomena (how shadows form, light follows straight lines) What a star is

Background and overview:

This presentation introduces students to the major scientific achievement of imaging the M87 black hole. First, they get familiar with concepts such as spacetime curvature, as is predicted by Einstein's General Relativity Theory. Afterwards, students are introduced to basic concepts regarding black holes creation and their form. Finally, they are shown the historical M87 black hole image and get informed exactly why it is so significant for scientific community, how long it took and how much effort needed to be completed.

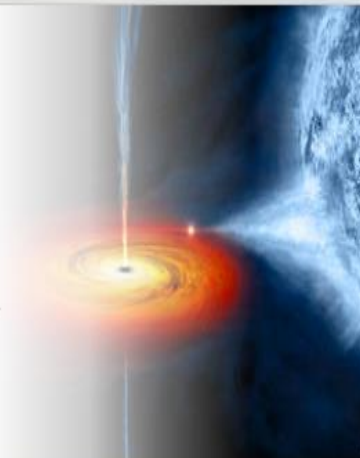
In addition, students, working in groups, will be given instructions and materials to construct their own black hole model based on the M87 black hole image. Finally, they construct (also in group work) a puzzle based on their black hole model photographs. Then, they send via email the stirred pieces to another group to solve the puzzle and they download and print another group's photos to solve their puzzle.

Finally, students will work to complete a working sheet based on the notions mentioned on the presentation and the YouTube videos.

Presentation for students

Teacher guidelines can be found in the notes attached to each slide

BLACK HOLES



Teacher Activities

Black hole M87: "An image that made history"

Authors: Stavroula Plerou, Foteini Lisgara

[Link to the activity](#)

[Link to additional resources](#)

Black Holes for everyone

Authors: Andreana Kovačević Čurić, Paulo Mesquita Fonseca

[Link to the activity](#)

Astronomical Fingerprints of Galaxies

Authors: Sophie Mikolajczak, Priya Hasan, Miltos Vavoulidis

[Link to the activity](#)

[Link to additional resources](#)

Sun: The Star of the Day

Authors: Daniela Maria Garaci, Maria do Rosário Tavares, Eleftheria Tzelatil, Angilella Catherine

[Link to the activity](#)

Does the Sun Rotate

Authors: Joann Dempsey

[Link to the activity](#)

[Link to additional Resources](#)

The Search for Exoplanets

Authors: Linda Healy, Dervilla Moran, Nectara Elena Mircioaga

[Link to the activity](#)

[Link to additional Resources](#) by Joann Dempsey

New Earth

Authors: Panagiotis Tsoumakis, Charoula Marinou, Thanos Leontios, Dimitris Zarpoutis, Nantia Papageorgiou, Christina Triantafyllou



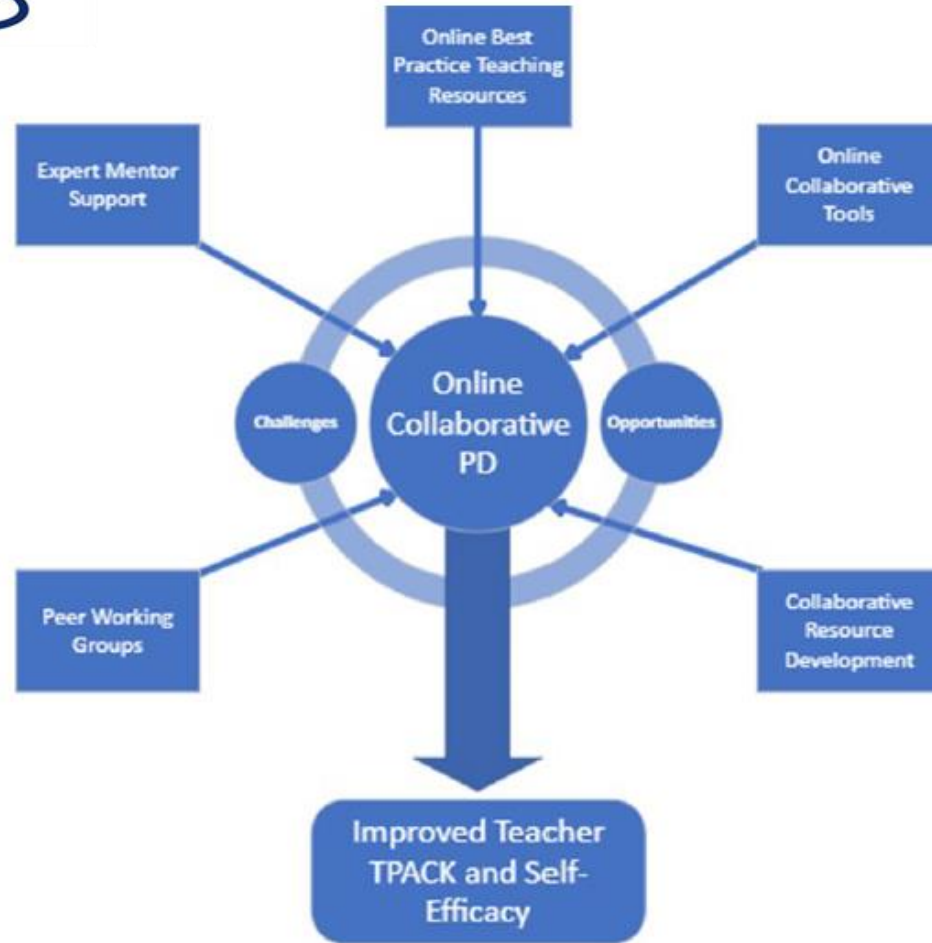
Astrophysics



Focus Group Findings: Thematic Map

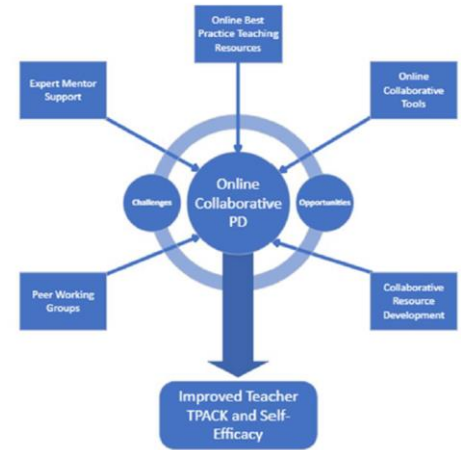
Key considerations for planning online professional development programmes that can meaningfully engage teachers.

Informed by relevant literature and the analysis of focus group data.



Online Best Practice Resources

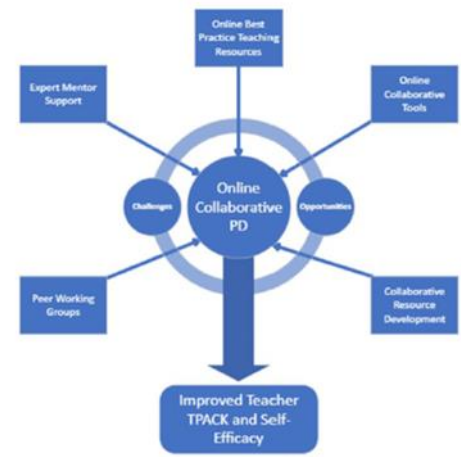
- Content-focused with models of best-practice
- Inquiry–based learning pedagogical framework
- TPACK integrated into professional development



“The frontiers demonstrators from the project are very innovative and very useful for teachers in the school in face to face and especially now in distance education.”

Peer Working Groups

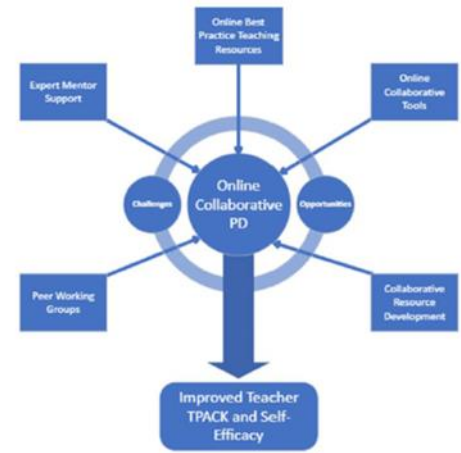
- Enhanced meaningfulness, agency and ownership
- Catalyst for further learning and exploration
- Interesting and exciting to find common ground
- Fertile ground for creativity
- International collaboration and opportunity to learn about other curriculums



“I found it very useful as I understood the demonstrator from the presentation but after the collaboration I understood many things much better as the other teachers gave many ideas about things that I didn’t notice or think about before.”

Collaborative Resource Development

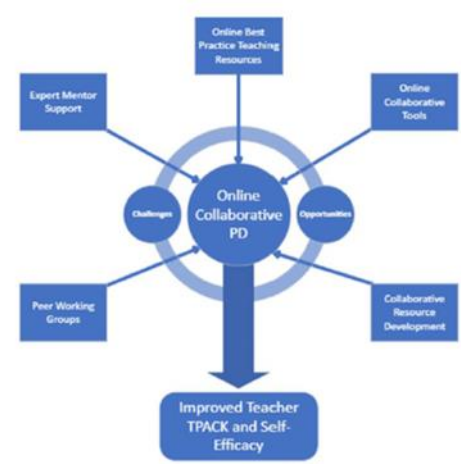
- Teacher co-created knowledge
- Stimulated meaningful discussion and TPACK
- Teachers adapted resources to meet curricula needs



“I had the chance to talk and discuss subjects and techniques and ideas with other teachers in my working group. For example, one of the teachers from another country was in the working group and we were able to talk about how to adjust ideas to different levels of education and it was nice to exchange ideas...”

Online Collaborative Tools

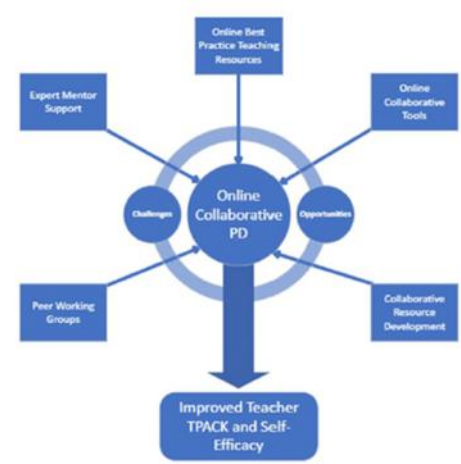
- Zoom
- Google Classroom
- Google Slides
- Synchronous and Asynchronous
- Collaboration beyond boundaries of time and space
- Language barriers bridged – live translation



“We had the chance to write what we think and talk through the chat and express our ideas and organise collaboratively what we wanted to do. It was a very convenient and easy way to collaboration...It was easily accessible to everyone.”

Export Mentor Support

- Expert mentors boosted the confidence of teachers
- Out of field teachers especially benefitted

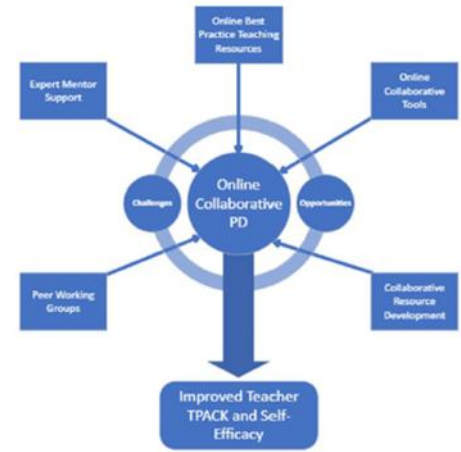


“During the working group we met the mentors and they helped us to understand basic physics phenomenon and that was very useful for me so I understood more... What is important was this meeting with mentors was very helpful to strengthen our confidence to talk to our own students about these topics.”

Considerations

- Local IT related issues
- Opportunity to access experts and facilities
- Prolonged screen time can be draining

- A blended multi-stage professional development provision supported
 - Online sessions over a few weeks rather than single block
 - Online working group times with support of expert mentor
 - Culminating in single in-person event



Feedback from Focus group

“We communicated via google slides and used the chat box to communicate with each other and it was a simple way to communicate”

“..if I had to choose one thing it would be the collaboration with colleagues far away from me.”

“Questions asked on the collaborative element of the e-Winter school, i.e. the collaborative tools of zoom and Google slides, the collaboration with other teachers and the international aspect of the collaboration”

“I understood the demonstrator from the presentation but after the collaboration I understood things much better as the other teachers gave many ideas about things that I didn't notice or think about before”

“I understood the demonstrator from the presentation but after the collaboration I understood things much better as the other teachers gave many ideas about things that I didn't notice or think about before”

“Although from different levels of education the working groups were a good chance to talk about ideas and exchange our ideas”

“We found something in common to introduce into our class so that was the most important thing”

There were presentations from participants from other countries and we got to listen to how they feel and how they think about physics.



Thank you!

indico.ego-gw.it/event/133/