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Challenge Based Learning ... applied to engineering courses

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Challenge Based Learning ... applied to engineering courses



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- The challenges of 21st learning...
- Challenge based learning...
- The Ocean example
- What I´ve just said ...

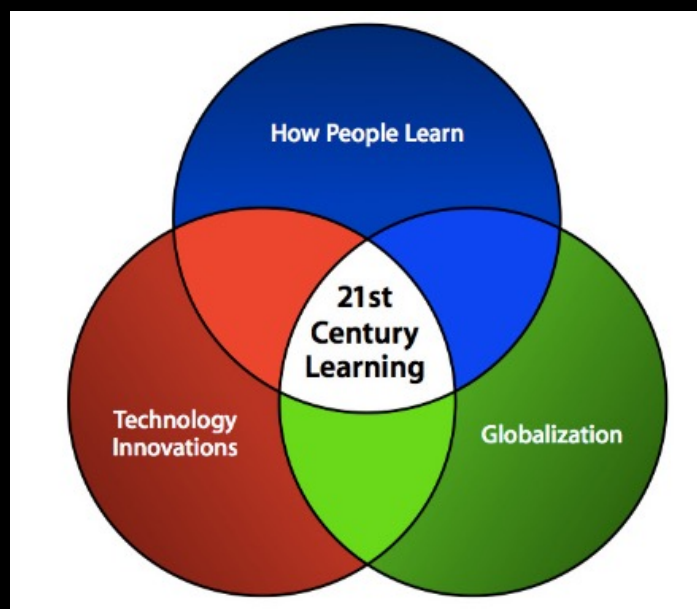
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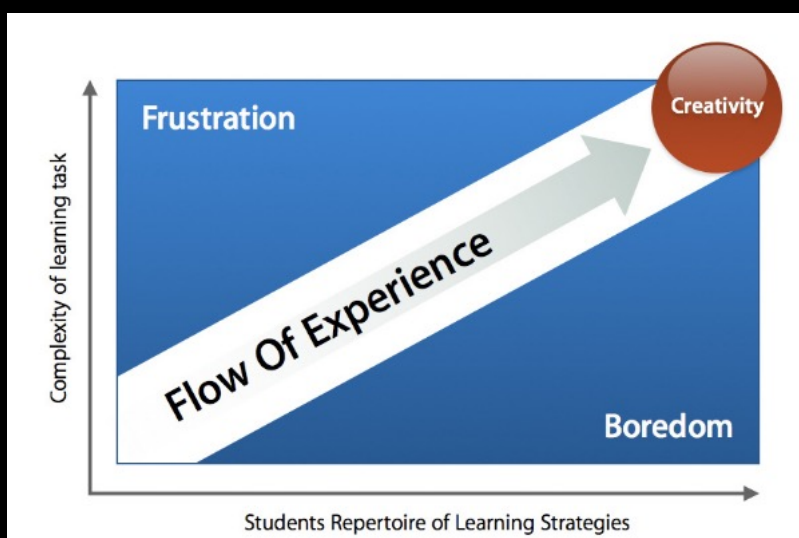
Three major influences on 21st century learning

https://www.challengebasedlearning.org/wp-content/uploads/2020/11/acot2_background.pdf



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The flow experience in learning

https://www.challengebasedlearning.org/wp-content/uploads/2020/11/acot2_background.pdf



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Deep Learning	Shallow Learning
Relating key concepts	Routine memorizing
Using evidence and developing schema	Following rote procedures
Focus is on growth and understanding	Focus is on minimum requirements
Intention is to seek meaning for yourself	Intention is to get it done

Deep learning versus Shallow learning

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- *Challenge Based Learning* is an effective learning framework initiated at Apple, Inc. and used in universities, schools, and institutions around the world

https://www.challengebasedlearning.org/wp-content/uploads/2020/11/acot2_background.pdf

- *Challenge Based Learning* provides a framework for participants to accomplish learning while building 21st century skills, developing a framework for life-long learning, and making an immediate impact on the world

https://www.challengebasedlearning.org/wp-content/uploads/2020/11/acot2_background.pdf



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- *Challenge Based Learning* framework is collaborative and hands-on, asking all participants (students, teachers, families, and community members) to:
 - identify Big Ideas
 - ask good questions
 - identify and solve Challenges
 - gain in-depth subject area knowledge
 - develop 21st-century skills
 - share their thoughts with the world

https://www.challengebasedlearning.org/wp-content/uploads/2020/11/acot2_background.pdf



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- Moving beyond the traditional hierarchy of the school and classroom, we can create environments where all stakeholders are working together to meet academic objectives while solving authentic Challenges
- Learn by doing

https://www.challengebasedlearning.org/wp-content/uploads/2020/11/acot2_background.pdf



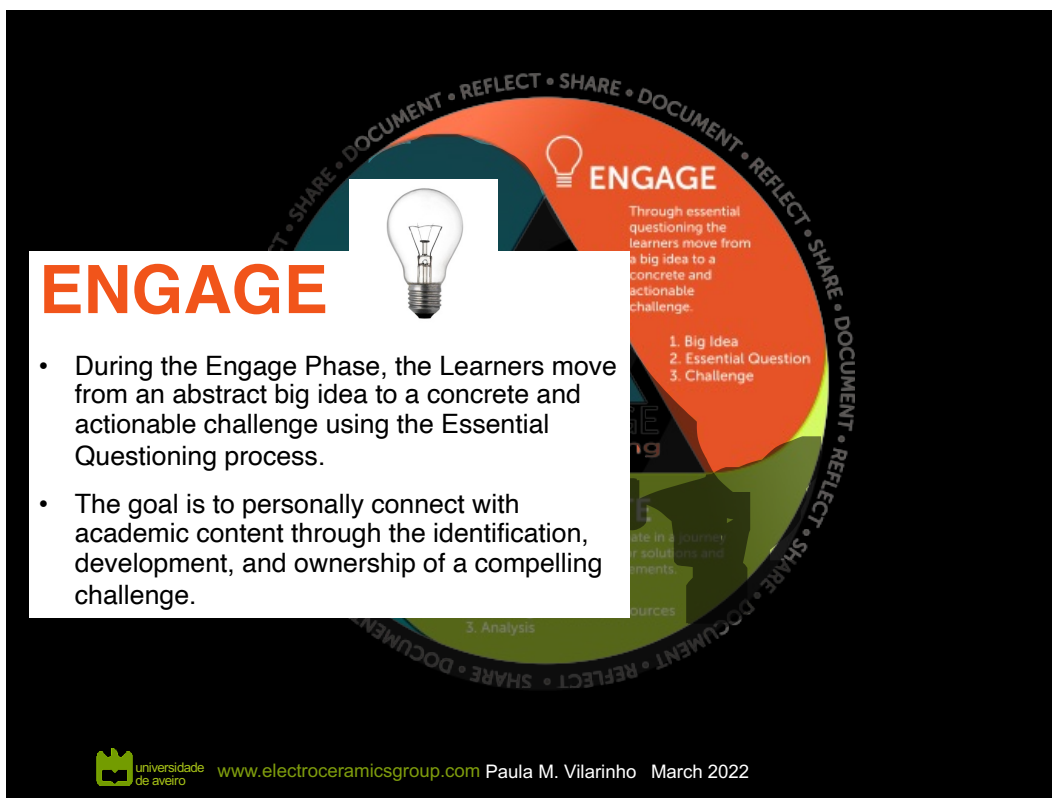
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ENGAGE

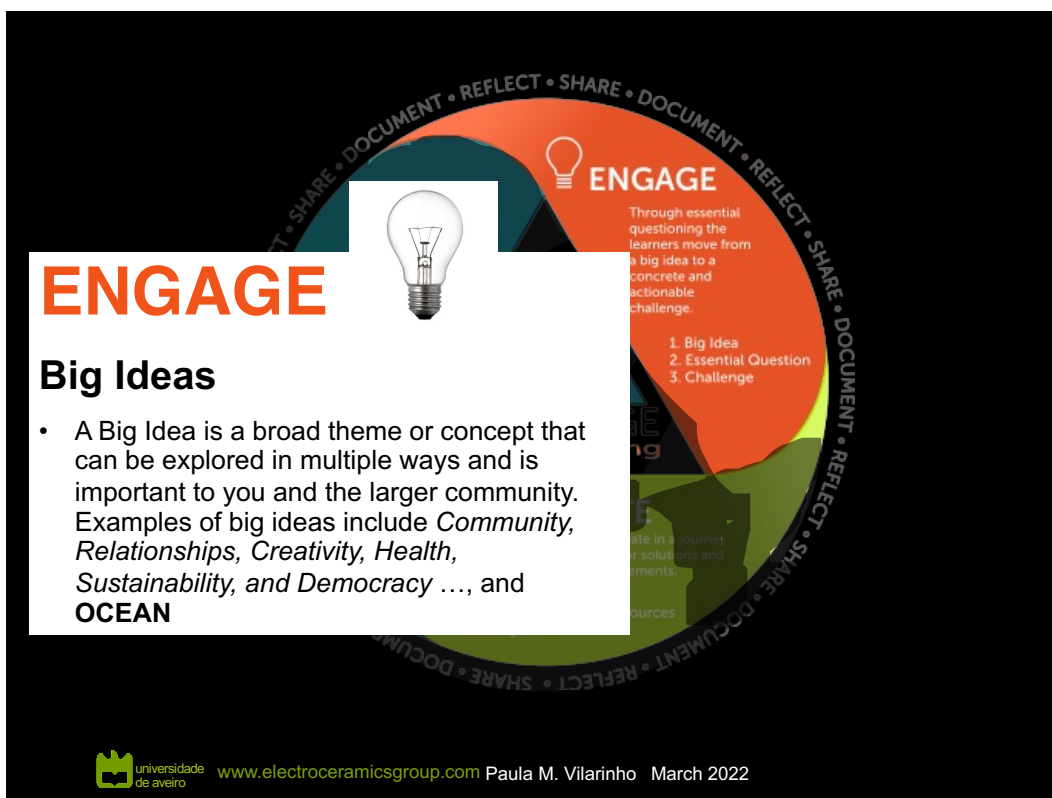
- During the Engage Phase, the Learners move from an abstract big idea to a concrete and actionable challenge using the Essential Questioning process.
- The goal is to personally connect with academic content through the identification, development, and ownership of a compelling challenge.

Through essential questioning the learners move from a big idea to a concrete and actionable challenge.

1. Big Idea
2. Essential Question
3. Challenge

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ENGAGE

Big Ideas

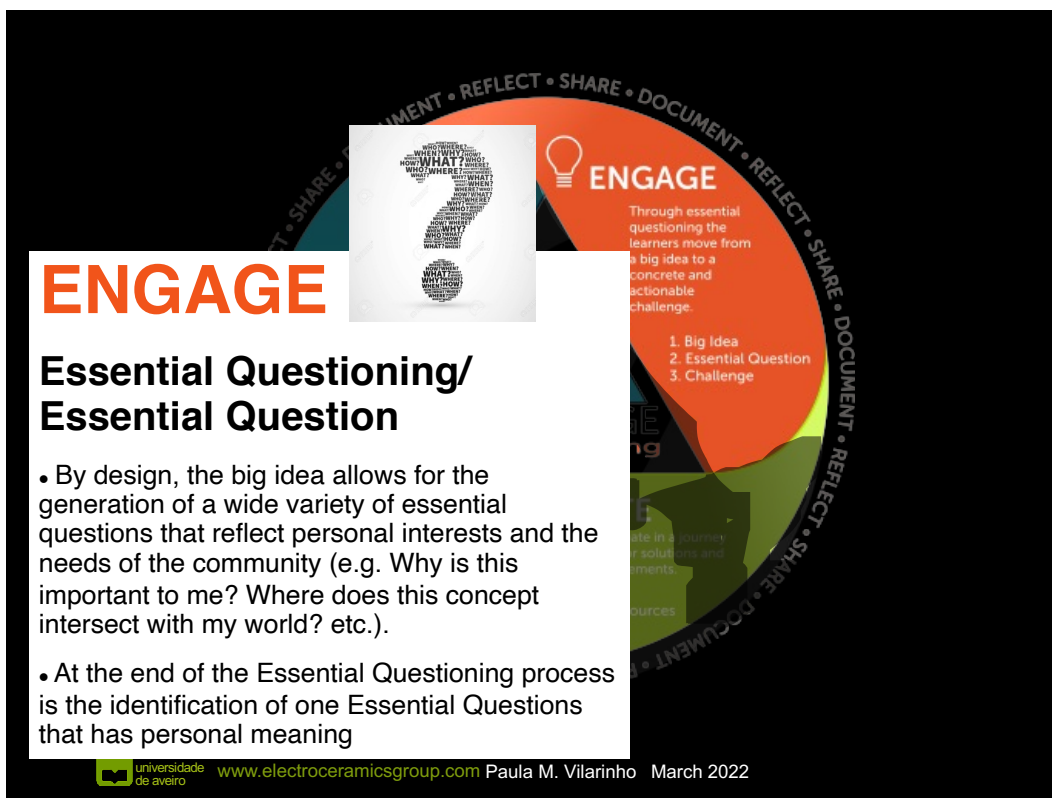
- A Big Idea is a broad theme or concept that can be explored in multiple ways and is important to you and the larger community. Examples of big ideas include *Community, Relationships, Creativity, Health, Sustainability, and Democracy ...*, and **OCEAN**

Through essential questioning the learners move from a big idea to a concrete and actionable challenge.

1. Big Idea
2. Essential Question
3. Challenge

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ENGAGE

Essential Questioning/ Essential Question

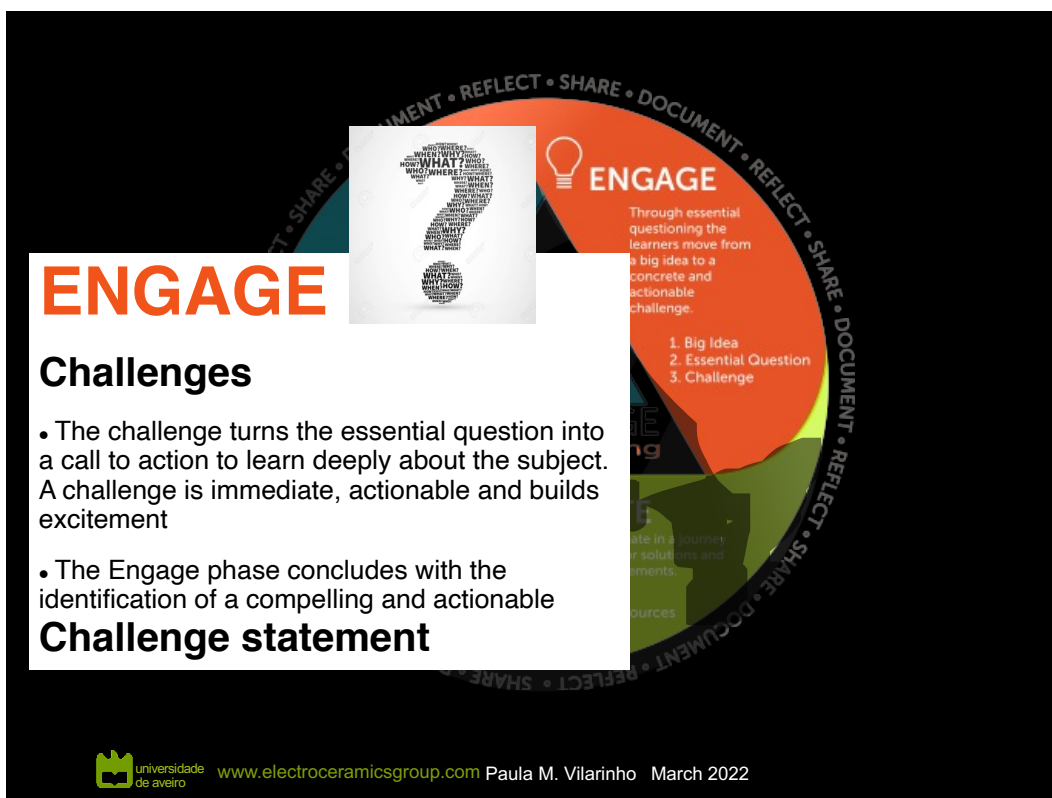
- By design, the big idea allows for the generation of a wide variety of essential questions that reflect personal interests and the needs of the community (e.g. Why is this important to me? Where does this concept intersect with my world? etc.).
- At the end of the Essential Questioning process is the identification of one Essential Questions that has personal meaning

Through essential questioning the learners move from a big idea to a concrete and actionable challenge.

1. Big Idea
2. Essential Question
3. Challenge

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ENGAGE

Challenges

- The challenge turns the essential question into a call to action to learn deeply about the subject. A challenge is immediate, actionable and builds excitement
- The Engage phase concludes with the identification of a compelling and actionable

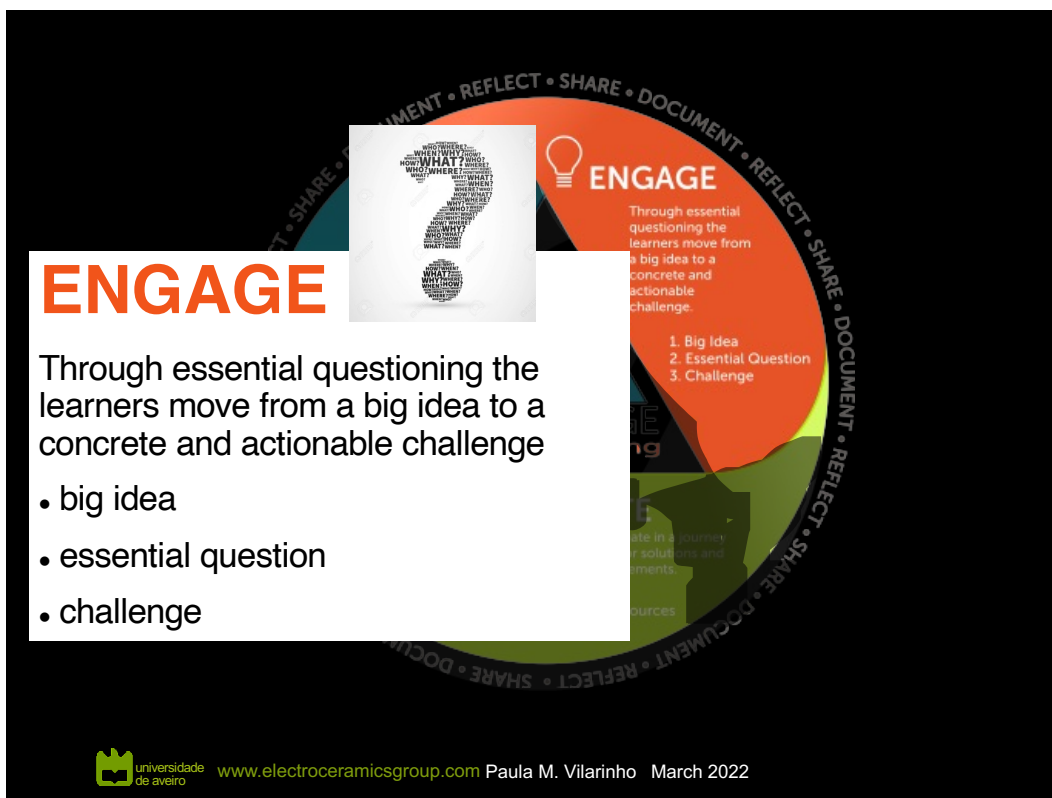
Challenge statement

Through essential questioning the learners move from a big idea to a concrete and actionable challenge.

1. Big Idea
2. Essential Question
3. Challenge

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ENGAGE

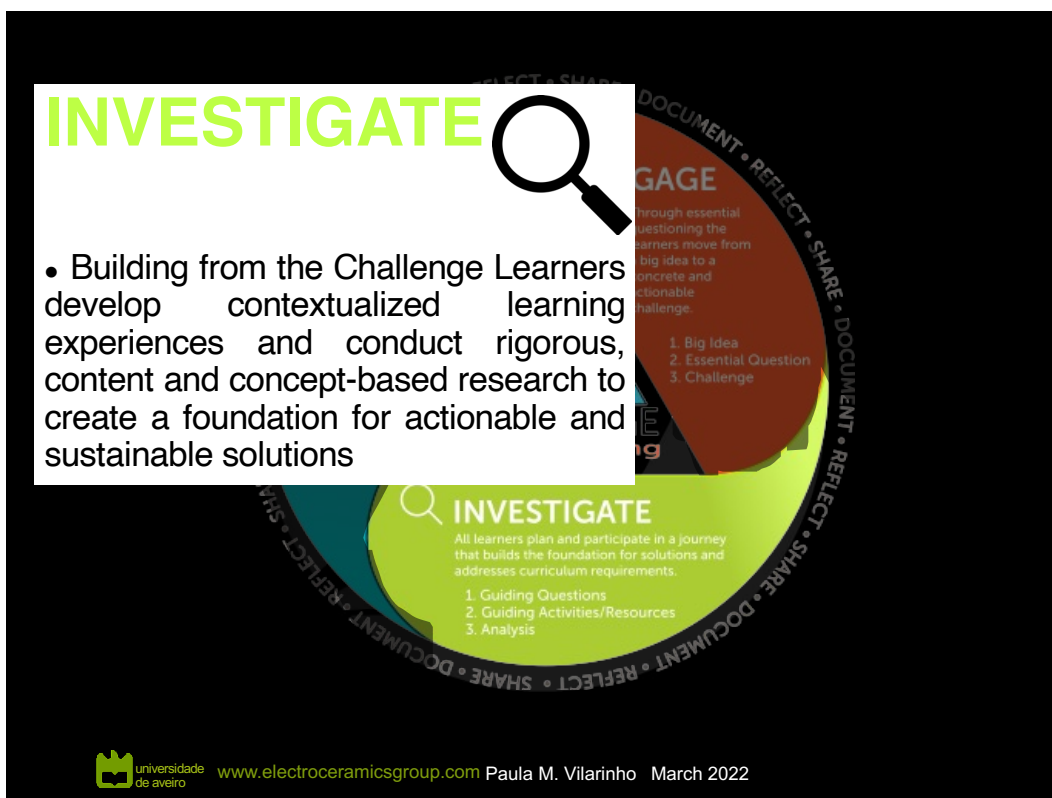
Through essential questioning the learners move from a big idea to a concrete and actionable challenge.

- big idea
- essential question
- challenge

1. Big Idea
2. Essential Question
3. Challenge

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INVESTIGATE

- Building from the Challenge Learners develop contextualized learning experiences and conduct rigorous, content and concept-based research to create a foundation for actionable and sustainable solutions

1. Guiding Questions
2. Guiding Activities/Resources
3. Analysis

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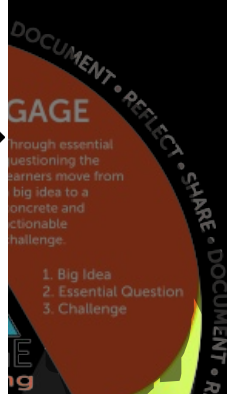
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INVESTIGATE



Guiding Questions

- The Investigation phase begins with generating questions related to the Challenge
- The questions include everything that needs to be learned to develop an informed solution to the challenge
- The questions are categorized and prioritized creating an outline for the learner's journey



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INVESTIGATE



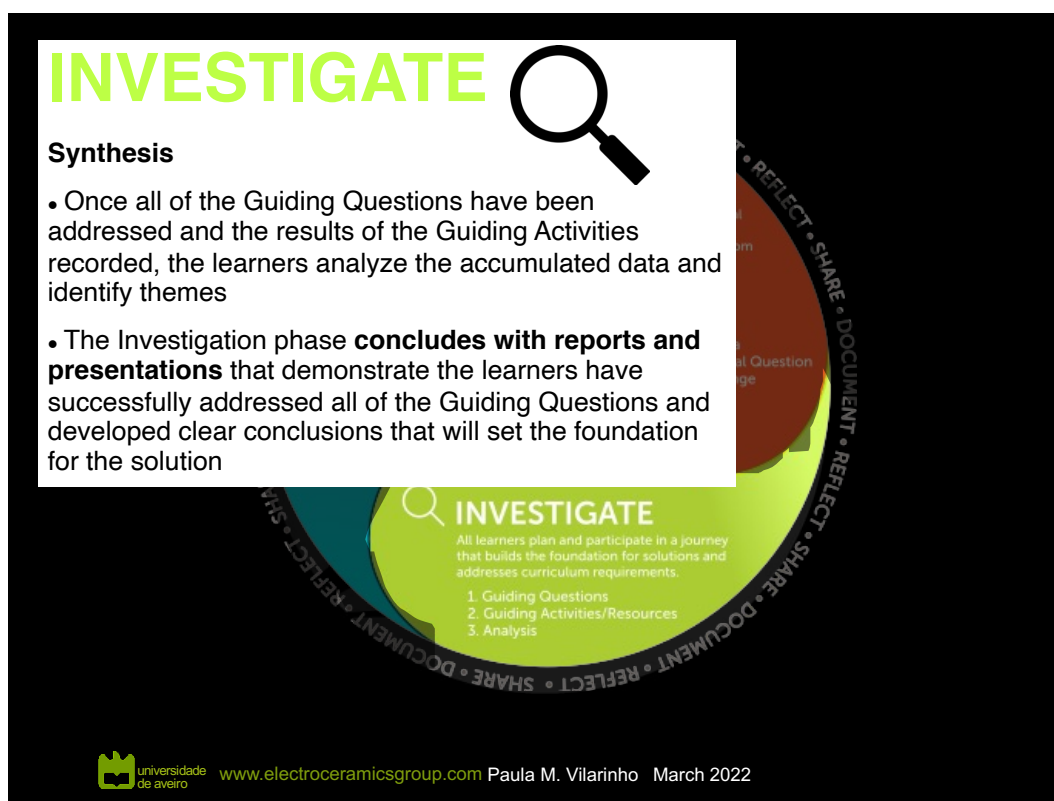
Guiding Activities/Resources


- Any resource or activity that helps answer the guiding questions and develop an innovative, insightful, and realistic solution can be used
- Examples of Guiding Resources include: online content and courses, databases, textbooks, and social networks
- Examples of Guiding Activities include: simulations, experiments, projects, problem sets, research, and games



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INVESTIGATE 

Synthesis

- Once all of the Guiding Questions have been addressed and the results of the Guiding Activities recorded, the learners analyze the accumulated data and identify themes
- The Investigation phase **concludes with reports and presentations** that demonstrate the learners have successfully addressed all of the Guiding Questions and developed clear conclusions that will set the foundation for the solution

INVESTIGATE
All learners plan and participate in a journey that builds the foundation for solutions and addresses curriculum requirements.

1. Guiding Questions
2. Guiding Activities/Resources
3. Analysis

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INVESTIGATE 

All learners plan and participate in a journey that builds the foundation for solutions

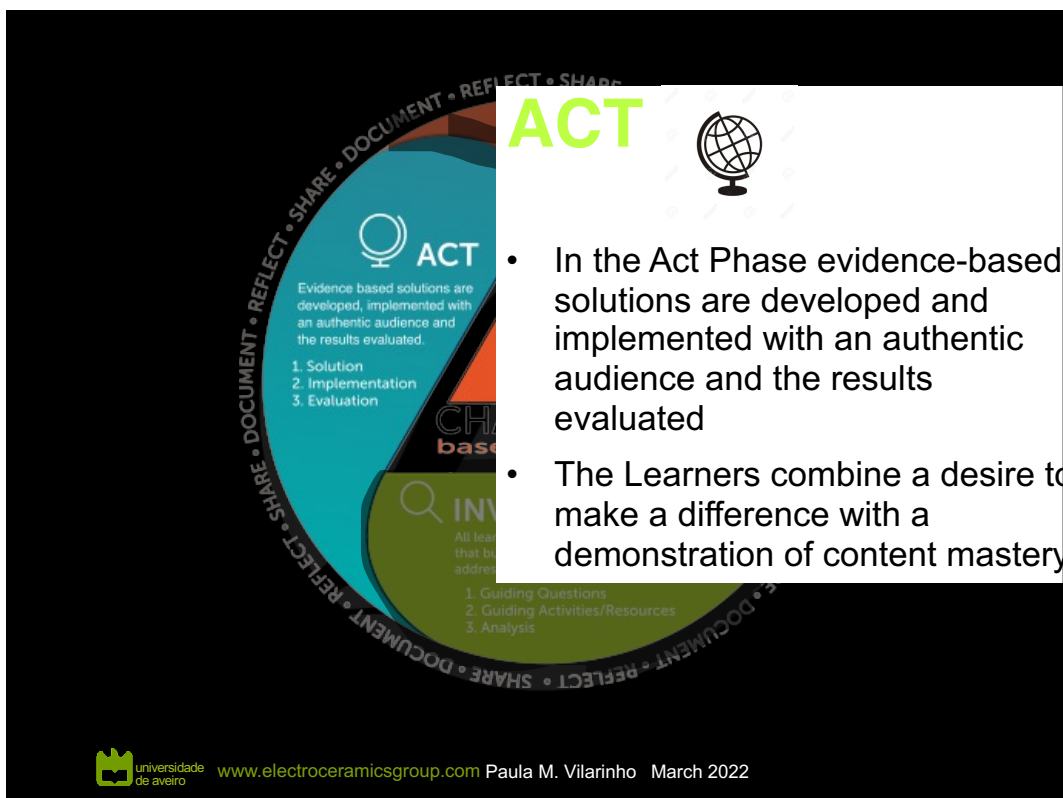
- Guiding questions
- Guiding activities / resources
- Analysis

INVESTIGATE
All learners plan and participate in a journey that builds the foundation for solutions and addresses curriculum requirements.

1. Guiding Questions
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ACT

- In the Act Phase evidence-based solutions are developed and implemented with an authentic audience and the results evaluated
- The Learners combine a desire to make a difference with a demonstration of content mastery

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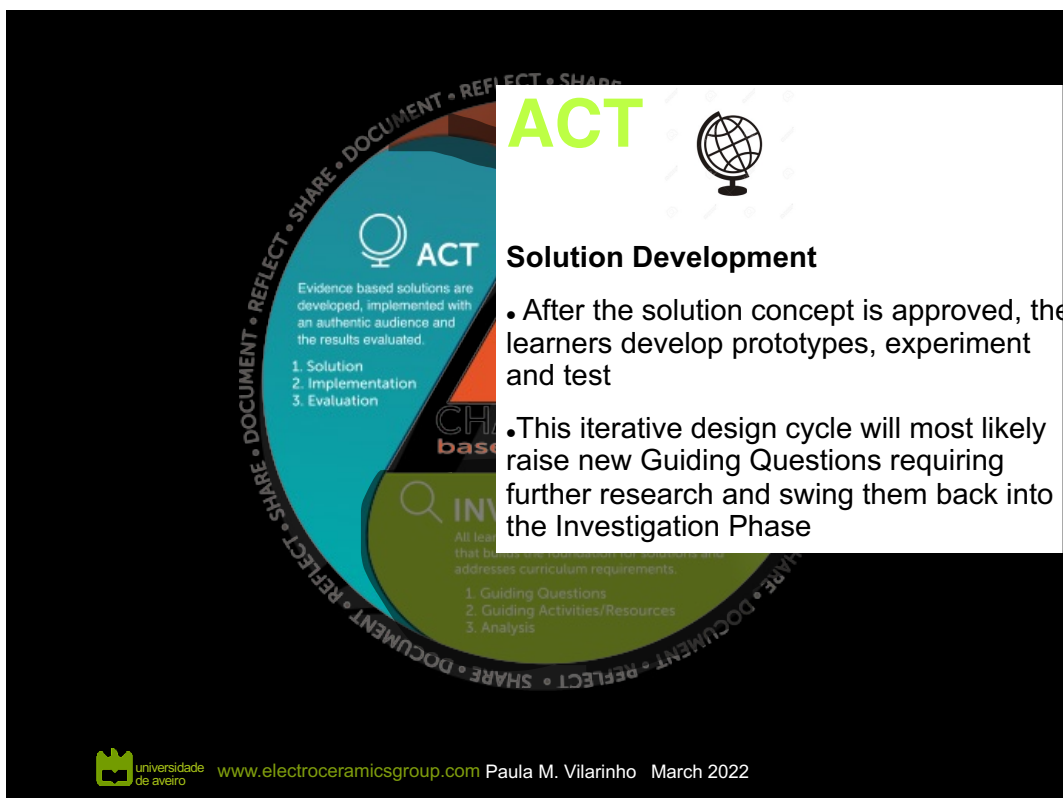
ACT


Solution Concepts

- Having completed the Investigation phase the learners have a solid foundation to begin developing solution concepts
- Solution concepts may involve plans for a campaign to inform or educate, school or community improvement projects, product development, or other activities.

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ACT 

Solution Development

- After the solution concept is approved, the learners develop prototypes, experiment and test
- This iterative design cycle will most likely raise new Guiding Questions requiring further research and swing them back into the Investigation Phase

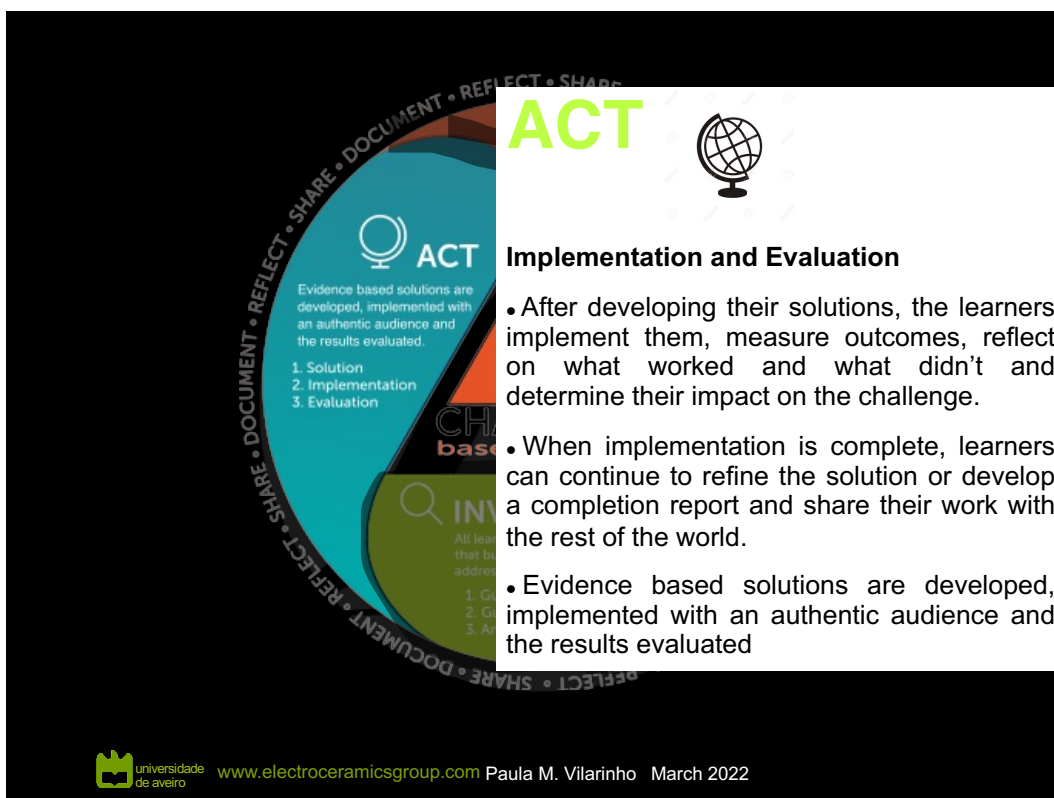
ACT
Evidence based solutions are developed, implemented with an authentic audience and the results evaluated.
1. Solution
2. Implementation
3. Evaluation


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base

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All lea
that b
addresses curriculum requirements
1. Guiding Questions
2. Guiding Activities/Resources
3. Analysis

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ACT 

Implementation and Evaluation

- After developing their solutions, the learners implement them, measure outcomes, reflect on what worked and what didn't and determine their impact on the challenge.
- When implementation is complete, learners can continue to refine the solution or develop a completion report and share their work with the rest of the world.
- Evidence based solutions are developed, implemented with an authentic audience and the results evaluated

ACT
Evidence based solutions are developed, implemented with an authentic audience and the results evaluated.
1. Solution
2. Implementation
3. Evaluation

CH
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1. Guiding Questions
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REFLECT, DOCUMENT, & SHARE

- Throughout the Challenge, Learners document their experience using audio, video, images, and photography
- The ongoing collection of content provides the resources for reflection, Informative assessment and the documentation of the learning process.

All learners plan and participate in a journey that builds the foundation for solutions and addresses curriculum requirements.

1. Guiding Questions
2. Guiding Activities/Resources
3. Analysis

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<https://youtu.be/CFCSvvsPWUA>

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Challenge Based Learning

The big SOCIETAL Idea:
The Ocean

1. ENGAGE

Through essential questioning the learners move from a big idea to a concrete and actionable challenge

- big idea
- essential question
- challenge

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Challenge Based Learning

1. ENGAGE

Stakeholders identification:

- Navy
- Weather control
- Governmental divisions
- Port authorities
- Water control division
- Scientists
- Fisheries & Fisherman
- Fish farmers
- Beach authorities
- Boats manufacturers
- Supermarkets
- etc.

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1. ENGAGE

The challenge(s)

- Control of quality of waters for bivalves farms (toxins, virus, bacterias, etc)
- In situ control
- Real time data acquisition
- Data management

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1. ENGAGE

The challenge(s)

- Open Ocean buoys
 - low cost
 - self powered
 - sensors
- In situ control
- Real time data acquisition
- Data management

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2. INVESTIGATE

develop contextualized learning experiences and conduct rigorous, content and concept-based research to create a foundation for actionable and sustainable solutions

- generating questions related to the Challenge
- Varied sources: scientific literature, patents, online content, on line resources, books, interviews, etc
- accumulated data and identify themes
- **built the foundation for solutions**

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2. INVESTIGATE

- Solution
- Implementation
- Evaluation

generating questions related to the Challenge

Varied sources: scientific literature, patents, online content, on line resources, books, interviews, etc

- accumulated data and identify themes
- **built the foundation for solutions**

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Learning

Challenge

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2. INVESTIGATE

- CHEMICAL SENSORES
- FLEXIBLE ELECTRONICS
- PIEZOELECTRIC BASED DEVICES
- PIEZOELECTRIC HARVESTERS

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Learning

Challenge

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3. ACT

- CHEMICAL SENSORES
- develop prototypes, experiment and test.
- FLEXIBLE ELECTRONICS
- PIEZOELECTRIC BASED DEVICES
- PIEZOELECTRIC HARVESTERS
- develop prototypes, experiment and test.

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- The challenges of 21st learning...
- Challenge based learning...
- The Ocean example
- **What I´ve just said ...**

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ACKNOWLEDGMENTS

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COMPETE

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Fundo Europeu de Desenvolvimento Regional

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FCT
Fundação para a Ciência e a Tecnologia

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Thank you
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- UA and CICECO
- our R&D

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- UA and CICECO
- our R&D



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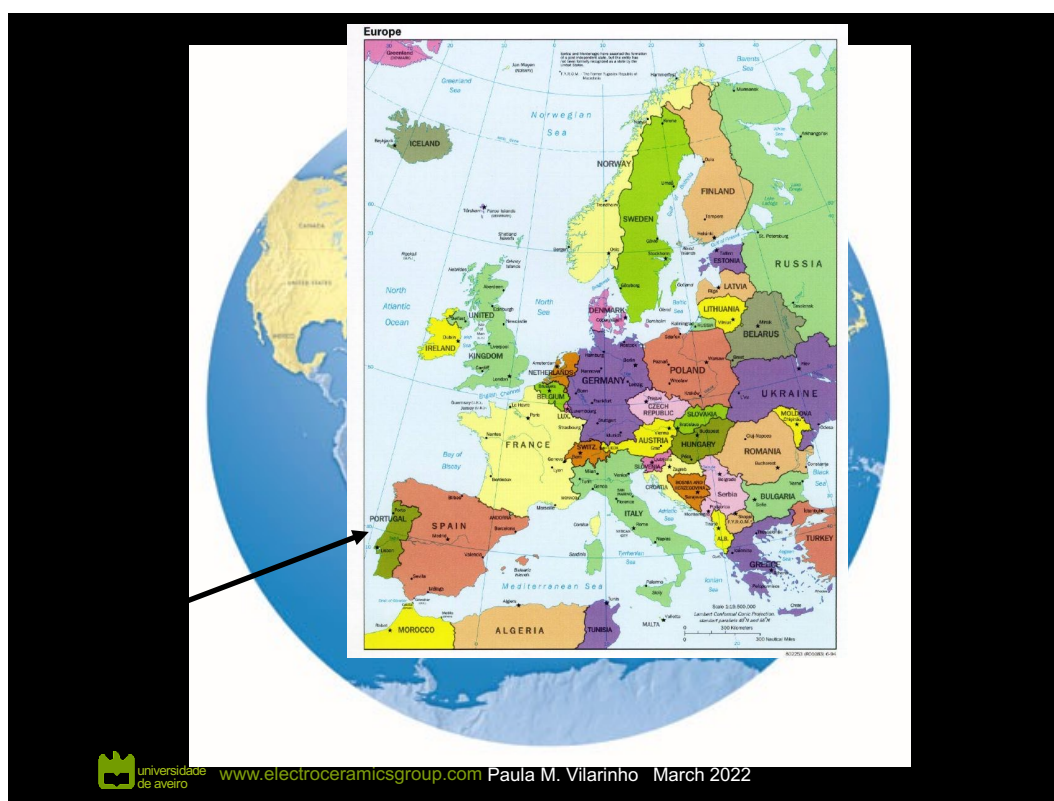
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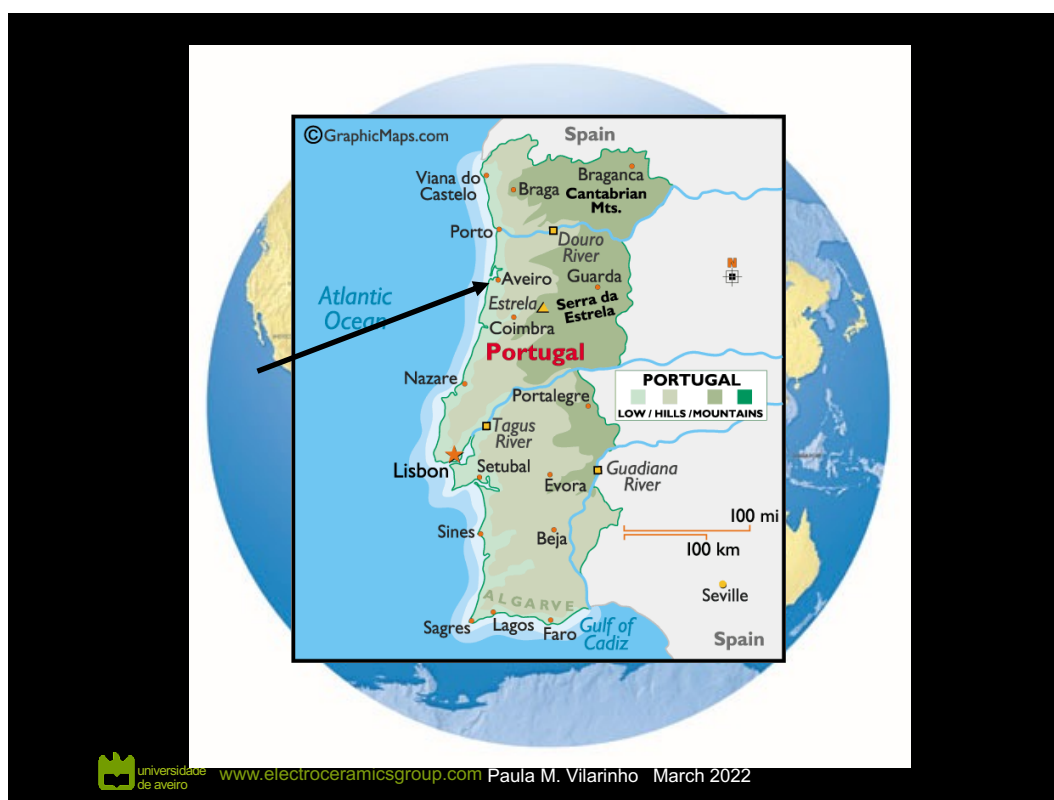
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University of Aveiro



Dept. of Materials and Ceramics Engineering

16 Departments
(14000 Students)

Degrees in
Materials Engineering: undergraduate, master and PhD



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THE WORLD UNIVERSITY RANKINGS PROFESSIONAL CAMPUS JOBS EVENTS RANKINGS STUDENT SERVICES

RANKING		SCORES					
Rank	Name Country/Region	Overall	Teaching	Research	Citations	Industry Income	International Outlook
601–800	University of Aveiro Portugal Explore	28.3–35.2	24.7	25.5	40.7	41.4	52.5

www.timeshighereducation.co.uk/world-university-rankings/


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World University Rankings 2020

The Times Higher Education World University Rankings 2020 includes almost 1,400 universities across 92 countries, standing as the largest and most diverse university rankings ever to date.


The table is based on 13 carefully calibrated performance indicators that measure an institution's performance across teaching, research, knowledge transfer and international outlook.



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4th in Portugal

www.timeshighereducation.co.uk/world-university-rankings


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THE TIMES HIGHER EDUCATION

PROFESSIONAL CAMPUS JOBS EVENTS RA

RANKING		SCORES				
Rank	Name Country/Region	Overall	Teaching	Research	Citations	Industry Income
351–400	Catholic University of Portugal Portugal Courses	42.4–44.4	18.3	15.0	94.6	35.9
401–500	University of Porto Portugal Courses	38.8–42.3	27.4	27.9	62.1	38.7
501–600	University of Lisbon Portugal Courses	35.3–38.7	25.2	29.8	52.7	39.2
601–800	University of Aveiro Portugal Explore	28.3–35.2	24.7	25.5	40.7	41.4
601–800	University of Beira Interior Portugal Courses	28.3–35.2	17.9	16.5	48.7	34.7

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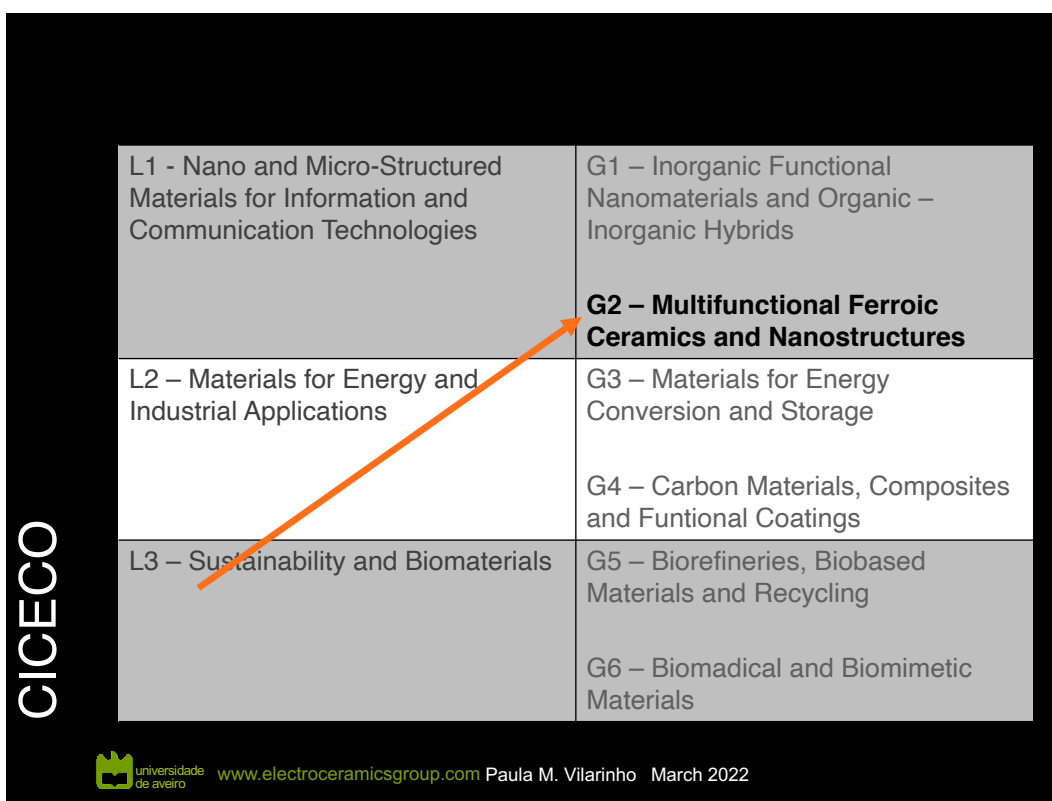
<https://www.dropbox.com/s/m2u9kli1v203z7h/CICECO%20PRESENTATION%202019.pptx?dl=0>



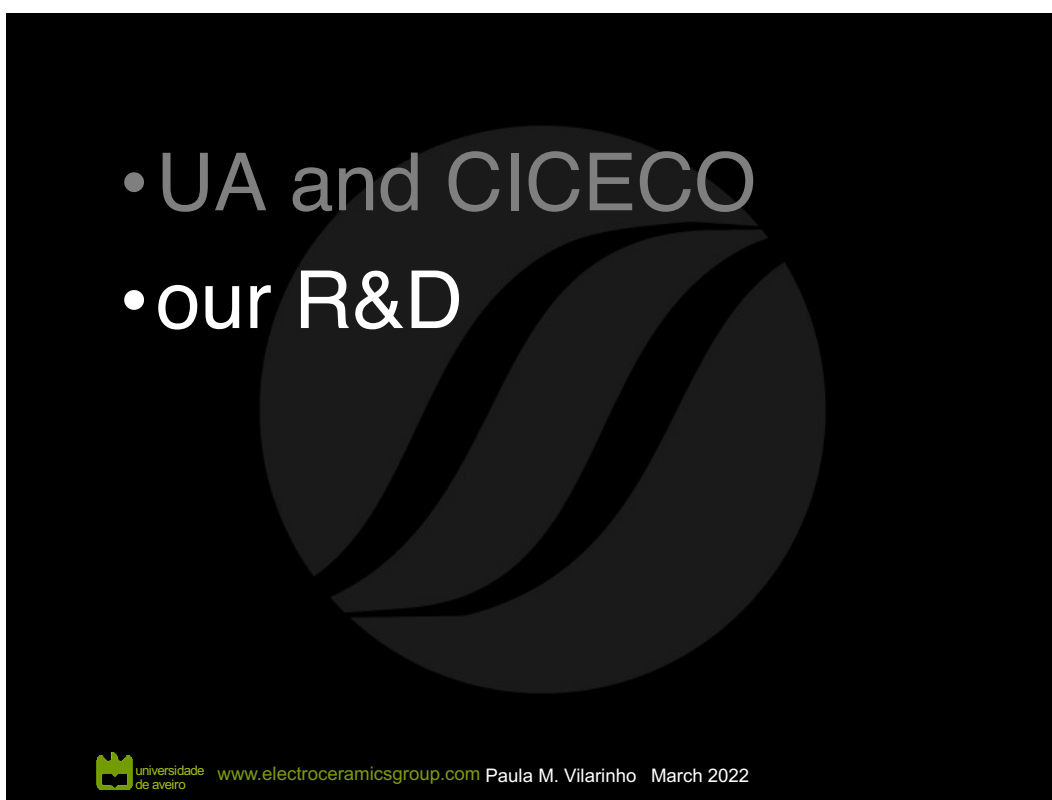
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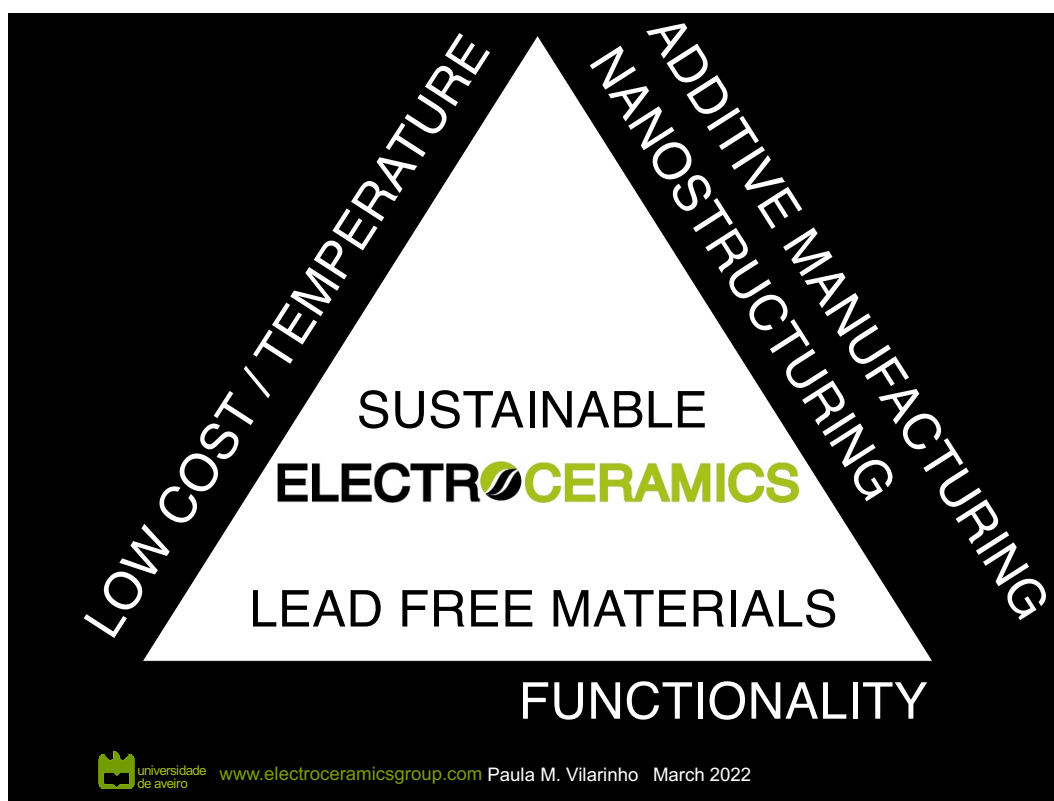
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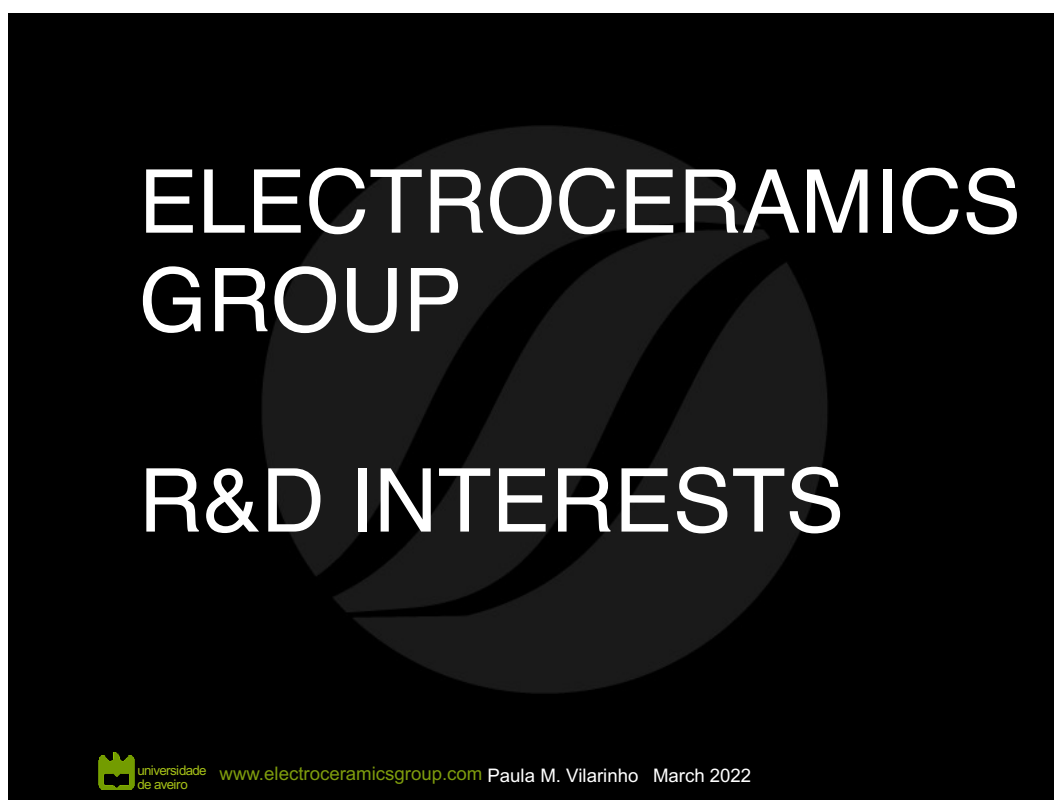
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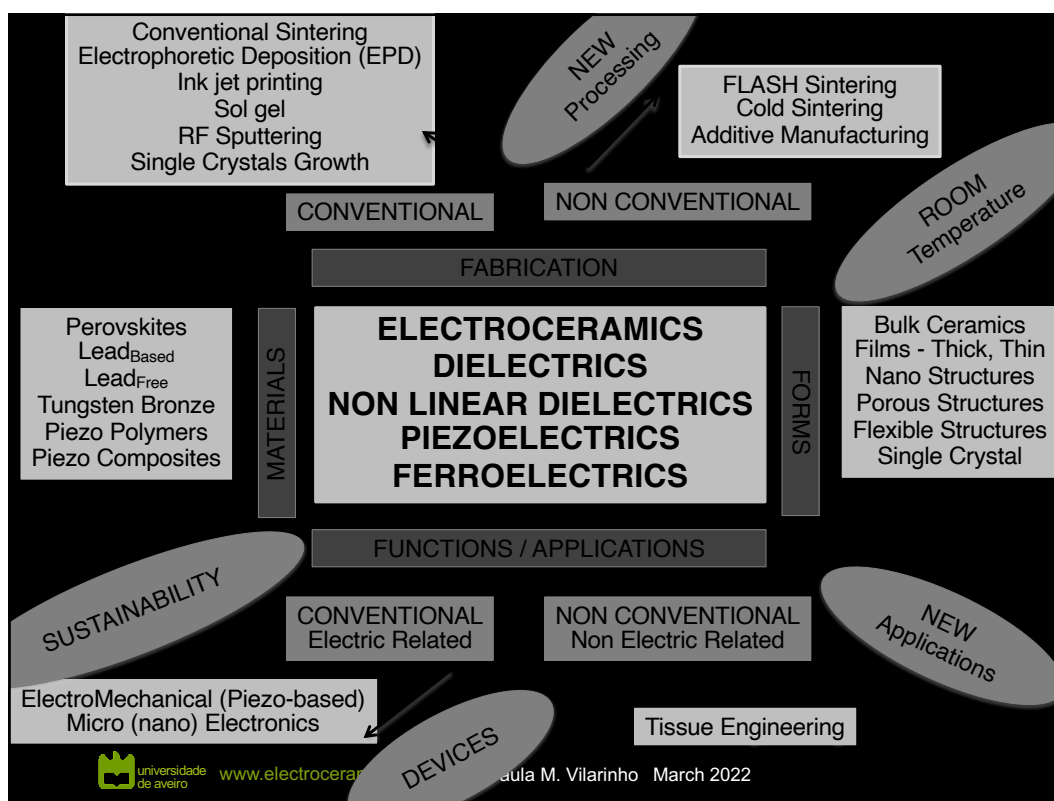
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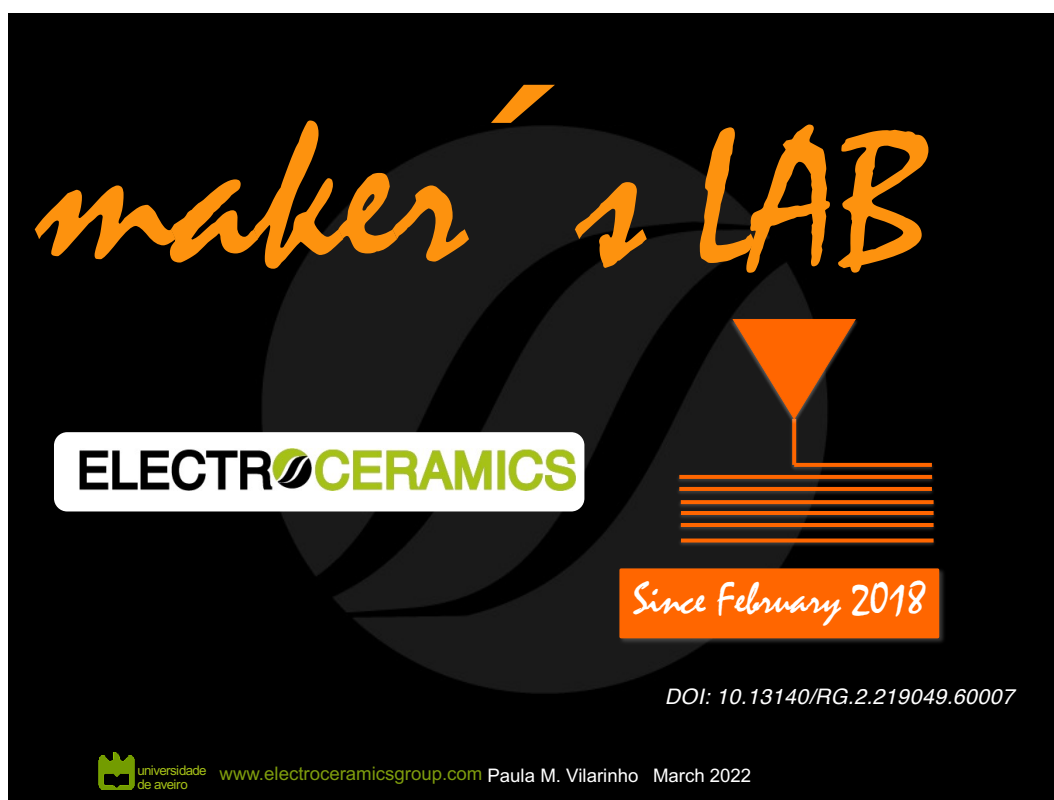
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ELECTRO CERAMICS



https://www.youtube.com/watch?time_continue=5&v=4B647jKJT30

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**Applications open
8 March – 7 April 2022**
Foundation for Science and Technology (FCT)

Pls see more info at:
<https://www.fct.pt/apoios/bolsas/concursos/individuais2022.phtml.en>

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THANKS FOR LISTENING

... to my ideas and EXPERIENCE



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