

Innovating nuclear engineering education and training through open and online culture

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- Production of a specialized MOOCs in a European project within H2020 led by ENEN: ANNETTE
- A dissemination course about Fukushima Dai-ichi accident in OCW and MOOC versions
- A pilot international online course on nuclear waste transmutation to be implemented and tested on a subject of UNED's Master in Industrial Engineering
- Online course on nuclear knowledge management for nuclear organizations
- Open database with the main available online open nuclear engineering educational resources
- A methodology for the recording of videos for Computer Science MOOCs for IN-CLOUD Erasmus+ project

IV. Conclusions and future work



- **Largest university in Spain (more than 200.000 students)**
- **43 years of distance education experience in higher education and life long learning**
- **Leader in the application and research of forefront technologies for teaching and learning (e.g. LMS developments, AVIP technology, mobile learning apps, virtual and remote laboratories, serious games, etc)**
- **Digital contents production (TV, radio, Internet broadcast, etc)**
- **Local centers (62 national and 15 abroad) and widest offer of virtual courses in Spain**
- **Pioneer in OER in Spain (OCW, OPEN UNED, MOOCs platform, digital repository). Awarded by different organisms (OW Consortium, Miriadax)**
- **EADTU quality label**

DIEEC DEPARTMENT (Research)

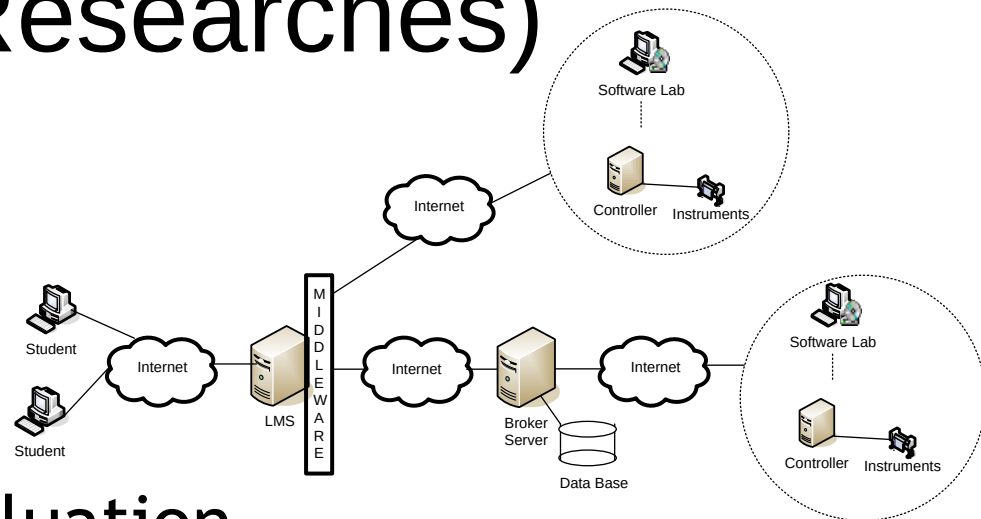
Departamento de Ingeniería Eléctrica, Electrónica y de Control

Research Areas

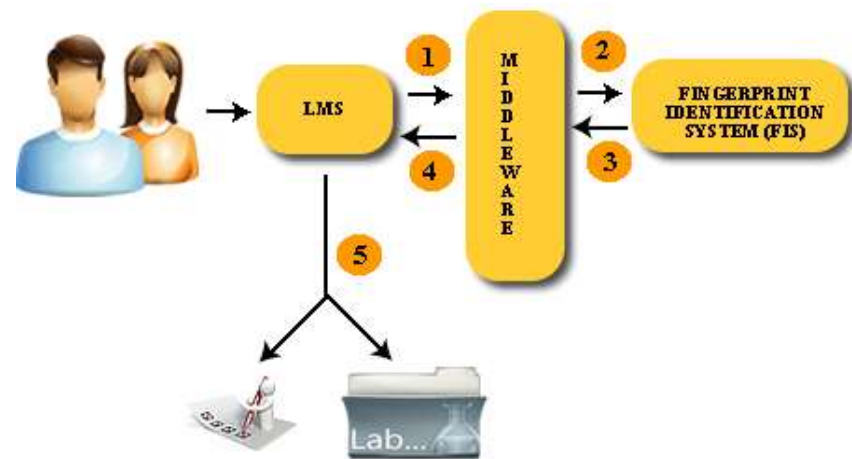
- Remote and online Labs
- Mobile and ubiquitous learning
- Biometrics in evaluation
- Augmented Reality
- Education Technology Trends
- Learning Objects / OCW / MOOCs
- Virtual Assistants
- QR Codes
- Serious Games

DIEEC DEPARTMENT (Researches)

➤ Remote Labs



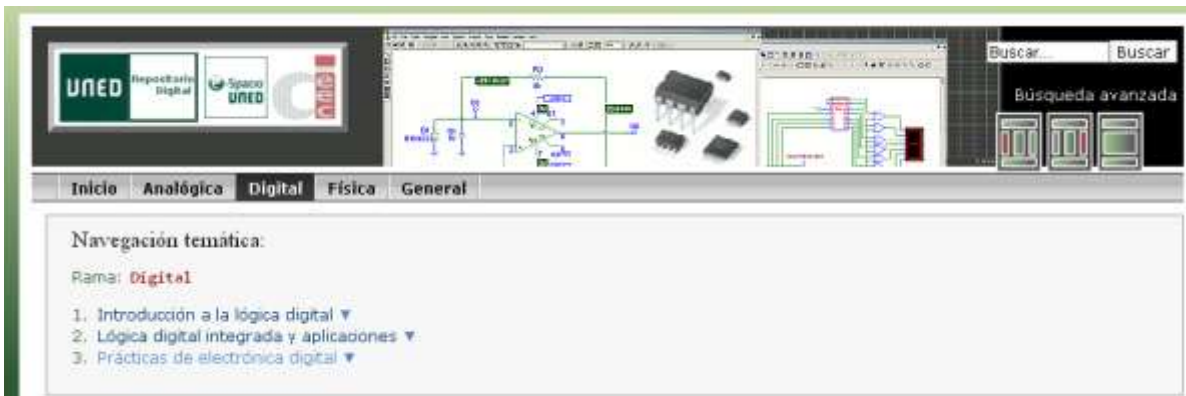
➤ Biometrics in Evaluation



DIEEC DEPARTMENT (Researches)

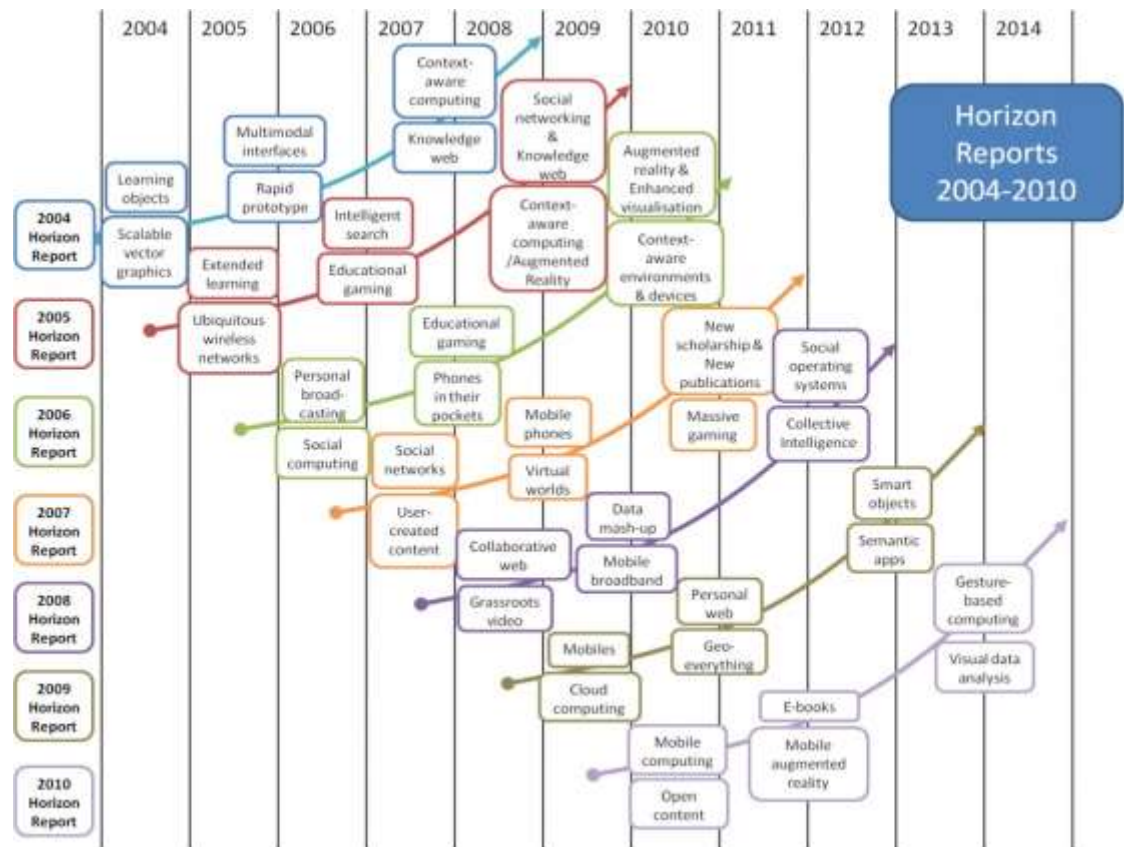
➤ Augmented reality →

➤ Learning Objects



DIEEC DEPARTMENT (Researches)

➤ Education Technology Trends



DIEEC DEPARTMENT (Projects)



IN-CLOUD. Innovation in Universities and Businesses - Erasmus+ Strategic Partnership nº 2015-1-IT01-KA202-00473



European Commission



Tempus

MUREE - Modernising Undergraduate Renewable Energy Education: EU Experience for Jordan
Programa TEMPUS: Acción de modernización - 530332-TEMPUS-1-2012-1-JO-TEMPUS-JPCR



GO-LAB



EUROPEAN COMMISSION

GoLab - Global Online Science Labs for Inquiry Learning at School
Programa FP7: Acción de investigación - FP7-ICT-2011-8 - Project number 317601

DIEEC DEPARTMENT (Projects)

	AUGE - Asesoría en Tecnologías Educativas y Gestión del Conocimiento
	Telefónica Learning Services - Cursos on-line masivos abiertos sobre Nuevas Tecnologías  UNED abierta  Miriada X
	eMadrid - Investigación y desarrollo de tecnologías educativas en la Comunidad de Madrid -S2013/ICE-2715
	COTEC-INNOESCUELA - Tecnología, Innovación y Propiedad Proyecto INNOESCUELA 

MOOC Platforms

- Miriada X: 2 MOOCs
- UNED Abierta: 2 MOOCs
- unX: 3 MOOCs
- WePrendo: 3 MOOCs



- Main features:
 - Spanish speaking countries
 - Videos
 - Communication between students
 - P2P evaluation
 - Community + social gamification (Karma, badges)
 - Content collaboration

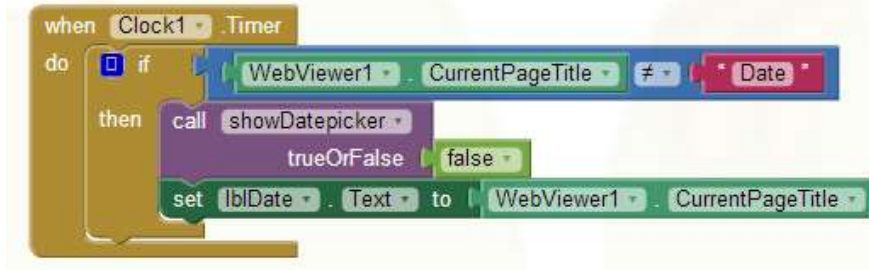


MOOCs in Miríada X



App development and entrepreneurship with App Inventor

- April 2015 – June 2015
- Mobile development for users without technical knowledge for Iberoamerica



Augmented Reality App development and entrepreneurship with Vuforia

- April 2015 – June 2015
- Innovative Augmented Reality apps for unemployed people in Spain



MOOCs in UNX



App development and entrepreneurship with App Inventor

- October 2012 – June 2014
- Mobile development for users without technical knowledge for Iberoamerica



App development for STEM teachers with App Inventor

- October 2013 – June 2014
- Mobile development for STEM teachers without technical knowledge for Iberoamerica

Augmented Reality App development for STEM teachers with Vuforia

- October 2013 – June 2014
- Innovative Augmented Reality apps for STEM teachers in Spain



MOOCs in WePrendo



P2P communication for App development and entrepreneurship: AllJoynt

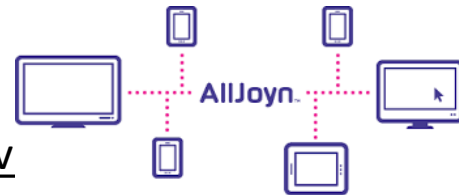
- September 2013 – June 2014
- Mobile apps with P2P communication

App development and entrepreneurship through context-aware serv

- September 2013 – June 2014
- Mobile development with context-aware services

Augmented Reality App development and entrepreneurship with Vuforia

- May 2013 – June 2014
- Innovative Augmented Reality apps for unemployed people in Spain

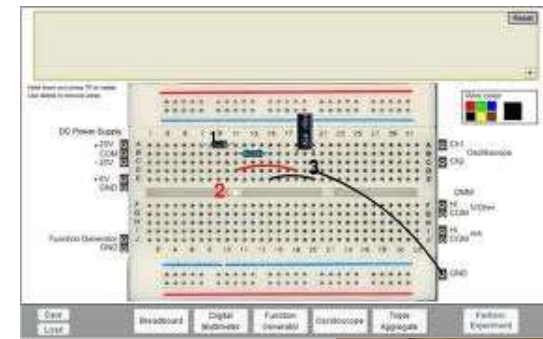


MOOCs



Open data practical course: Business opportunities linked to open data

- October 2012 – December 2013
- Research about Open and Linked Data



Electronics experimentation with a remote laboratory (VISIR)

- April 2013 – June 2014
- The first international MOOC published with a remote lab.
- Experimentation with real analogue circuits through the Web using a remote lab for electronics.





DIEEC DEPARTMENT (Links)

<http://www.ieec.uned.es/>

<http://ohm.ieec.uned.es/>

Research on Technologies for Engineering Education
Electrical & Computer Engineering Department (DIEEC) | Spanish University for Distance Education (UNED)

Menu

- 1. Introduction
- 2. Labs
- 3. Labs Information
- 4. Integration of Labs in (DIEEC)
- 5. Virtual and Remote Labs
- 6. OHM Remote Lab
- 7. Management Systems
- 8. LMS
- 9. OHM Remote Lab
- 10. OHM - Electronic Remote Lab
- 11. OHM Remote Lab
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- 100. OHM Remote Lab

Presentation

The DIEEC Research Lab is devoted to the advancement of knowledge and improvement of distance engineering education, especially. The main research areas are the following:

- Virtual/Remote Labs
- Learning Objects
- Learning Management Systems
- Biometrics
- Mobile Learning
- Open Hardware
- Social Media
- Technology Trends

Useful Links

- 1. Open Hardware
- 2. Open Hardware
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<http://www.ieec.uned.es/>

INICIO | MAPA SITIO | REGISTRO DIEEC | SOFTWARE DIEEC | CONTACTO | USO PRIVADO

TEL: +34 91 3966480 FAX: +34 91 3988028

ETSE Industriales - c/ Juan del Rosal, 12 C. Universitaria - Madrid 28040

Cursos Iniciar

UNED

Distancia | P. Fin Carrera | Investigación | Congresos | Personal | DIEEC

SERVICIOS

- Asistente Virtual
- Grabación de audio
- Solicitud revisión exámenes
- Open Course Ware
- Procedimientos Ingresos UNED
- Virtual Online Laboratory Consortium

WEBS DE INTERÉS

- Portal Educativo del DIEEC
- Portal Tecnologías Educativas
- UNED
- E.T.S. Ingenieros Industriales
- E.T.S. de Informática
- Cátedra UNESCO

WEBS DEDICADOS

- IEEE
- OCW
- GOLC

CONVENIOS COLABORACIÓN DIEEC

PATROCINIOS DIEEC

NOVEDADES

15/07/2011 Matrícula Cursos F. Continuos 2011/2012

Ya está abierta el periodo de inscripción de los cursos de Máster, Especial y Enseñanza Abierta. El periodo de inscripción es hasta 30 de noviembre.

<http://vota.es.uned.es>

UNED Nuclear Engineering part of the Power Engineering Department

➤ Engineering Education

- Bachelors
- Masters
- Doctorate studies

➤ Nuclear Engineering Research activities

- TECF3IR research group led by Javier Sanz www.tecfir.com
 - ✓ Activation and neutron analysis studies mainly in fusion applications computer developments and applications for nuclear analysis, activation analysis and applications to safety, waste management and radioprotection analyses in the nuclear field
 - ✓ UNED main researcher in over 40 national and international projects and responsible of the development of ACAB activation code
 - ✓ Currently is leading several activities within Fusion for Energy, ITER IO, and EUROfusion (Euratom/Horizon 2020), some in the frame of the Safety Program for DEMO.
- Innovation in nuclear engineering ETI activities
 - ✓ Group coordinated by Mercedes Alonso

Our approach in the context of nuclear education

- The need of a highly effective communication, mainly in issues concerning nuclear safety culture, demands a new approach in education, training and information (ETI) activities.
- Open Course Ware (OCW) and Massive Online Open Courses (MOOCs) could be very helpful for the dissemination in nuclear engineering, especially regarding the extended nuclear phobia in our society.
- Online and blended learning can be spread to cover special training needs nationally and internationally
- Nuclear Knowledge Management is a very relevant topic, and very much related to education, so we are also working in this direction to have a broader view of the educational needs

We are gathering UNED very valuable expertise to bring education innovation to the nuclear engineering field

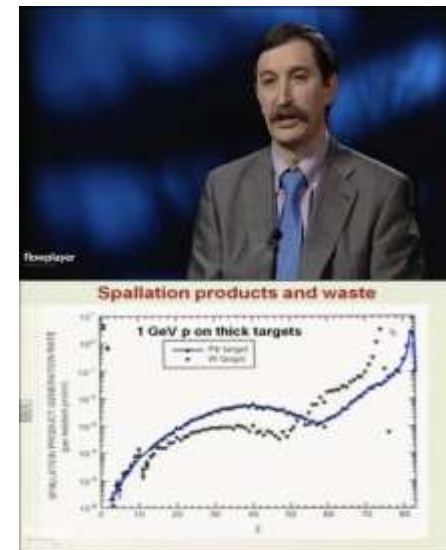
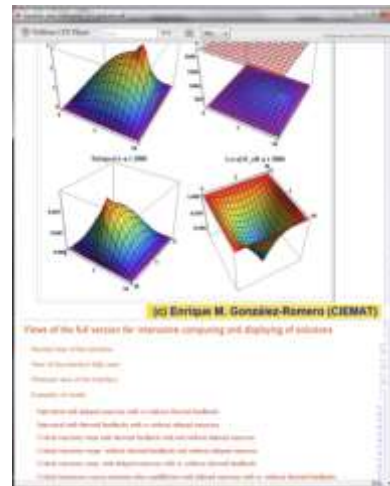
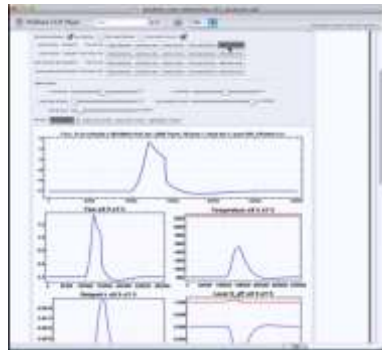
Early approaches to online courses and MOOCs

- Online pilot course on ADS systems in collaboration with CIEMAT within the 7th Framework Program of ENEN.

[Access to the open video of the presentation in NESTet2013 \(psw: nuclear\)](#)

- Redesign the pilot course on ADS Systems into a MOOC.

[Access to the open video of the presentation in IYNC 2014](#)



Early approaches to online courses and MOOCs

- A MOOC for the medical doctors sector, addressing safety culture in all types of nuclear activities including security applications, was offered during the 2nd stakeholders meeting of FP7 NUSHARE Project.



To shorten the knowledge gap between nuclear specialists and the general public promoting knowledge development about the field through **open online educational contents**



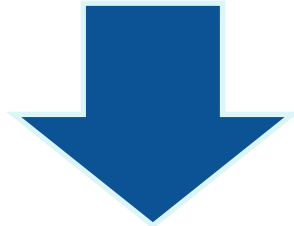
European Union
Objectives

Nuclear Safety Culture improvement

**Open learning in
Nuclear Engineering:
State of the art**

OPEN ONLINE COURSES ON NUCLEAR ENGINEERING

UNED: Extensive search on open educational
resources



**Scarce offer of OER and open courses on
nuclear engineering**

Two MOOCs in Nuclear Engineering

The screenshot shows the Coursera interface for the course 'Una Mirada a la Física Nuclear y la Tecnología' (A Look at Nuclear Science and Technology) offered by the University of Pittsburgh. The page includes a header with the Coursera logo and navigation links. The main content area features a large image of a nuclear power plant with a person riding a bicycle in the foreground. Below this, there is a section titled 'Acerca del Curso' (About the Course) and another titled 'Programa del Curso' (Course Program). A video player is visible at the bottom, showing a lecture by Larry Foulke.

Una Mirada a la Física Nuclear y la Tecnología

This course will focus on the theory, design and operation of commercial nuclear power reactors. The course will also touch on contemporary issues regarding nuclear power generation including: the nuclear fuel cycle, the economics of nuclear power, and nuclear non-proliferation.

Acerca del Curso

The course, "A Look at Nuclear Science and Technology" is aimed at scientifically inclined individuals who want to learn more about nuclear energy and the nuclear power industry. It will address subjects such as: What is nuclear energy? What is its history? Who are its heroes? Why is it controversial? How do nuclear power plants work? What about nuclear weapons? What are the stereotypes and misconceptions? We expect many students who finish this class to want to go on for further study in a closely related field.

Programa del Curso

"A Look at Nuclear Science and Technology" is an overview course that provides broad subject-area coverage to introduce students to application of theory to practical aspects of nuclear science and technology in the world today with special emphasis on commercial nuclear power. The course will begin with a general overview of nuclear physics and the practical applications covered by the field of nuclear engineering. The majority of the course will focus on the theory, design and operation of commercial nuclear power reactors. The course will also touch on contemporary issues regarding nuclear power generation including: the nuclear fuel cycle, the economics of nuclear power, and nuclear non-proliferation.

The course will begin with a grand tour of the commercial nuclear fuel cycle and power reactors so the student will have some perspective before diving into the theory that is important to understanding the unique aspects of nuclear energy. The course then will return to the fundamentals of basic nuclear physics, reactor physics, energy removal and power conversion to prepare students for in-depth

**Pittsburgh
University**



[View transcript](#)

ABOUT THE COURSE

With the need to reduce carbon emissions around the world, the way we generate our power has to change and nuclear energy is back on the political agenda. But do you know your fission from your fusion? Would you like the knowledge to make an informed decision?

The question of whether we should get electricity from nuclear power remains a tough one for governments all over the world. While it offers a sustainable, low carbon and secure way of meeting our energy needs, big questions surround the economic viability, the perceived dangers and the public acceptability associated with power plant operations and radioactive wastes.

Nuclear power stations currently generate around 18% of the UK's electricity production. The majority of the current reactors are scheduled to be decommissioned by 2033 and we could be facing an energy 'gap'.

This free course will delve into the science behind nuclear power and explain what happens inside a nuclear reactor and what it means for an element to be radioactive. It will explore some of the risks of producing



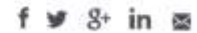
FREE online course

Duration: 4 weeks

3 hours pw

Certificates available

SHARE



START DATES

TBA [Register interest](#)
DATE TO BE ANNOUNCED

EDUCATORS

Sam Smith and Gemma Warriner



[Access to the general information about the MOOC](#)
[Access to the actual MOOC in its FutureLearn platform](#)

The new MOOC from Open University [The Science of Nuclear Energy](#) started 23 may 2016

Access to the open video of the presentation:

["MOOCs in Nuclear Engineering – Challenges and Opportunities"](#)

1st international Conference: MOOCs: Present and Future. International Perspectives. Nov 2014

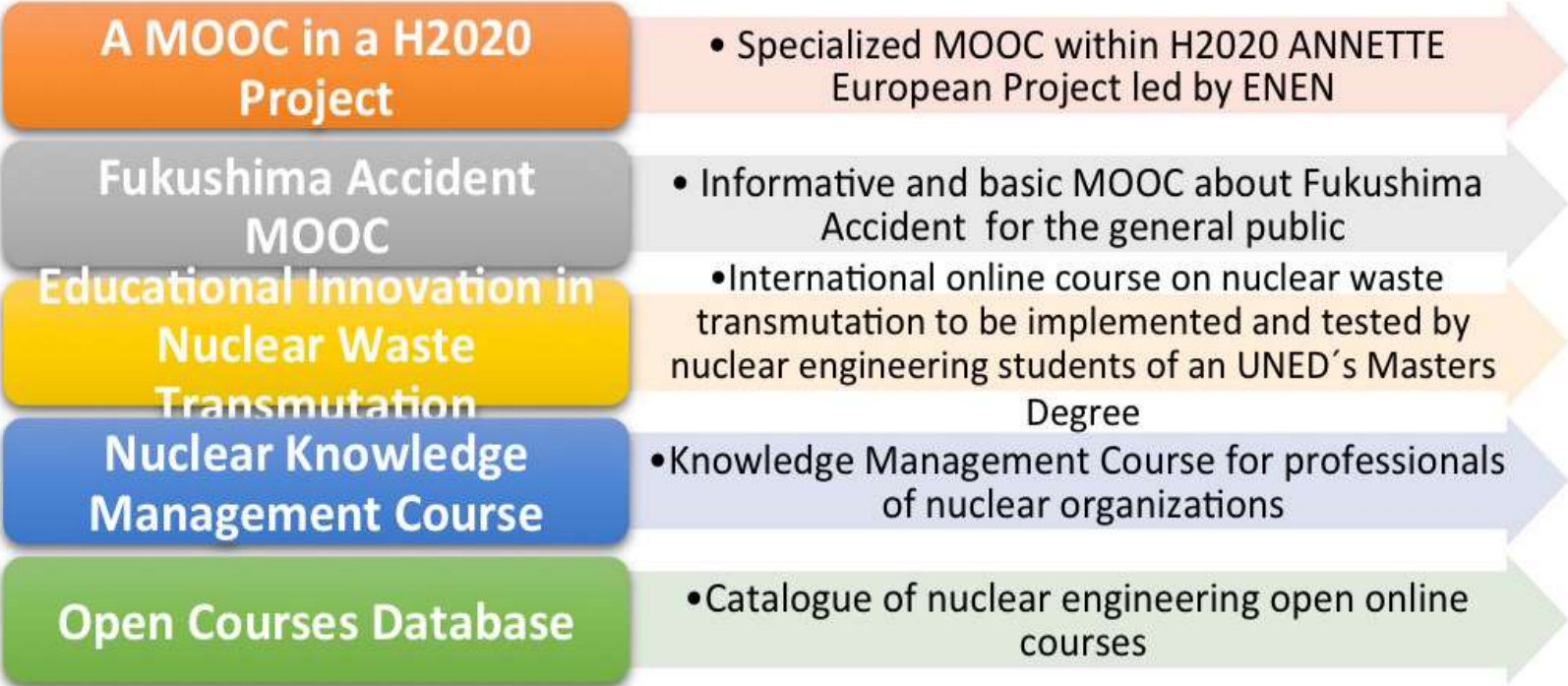
Access to the 3 presentations on Digital Learning for XXI Digital Learners

[1st part: The role of digital technologies in the modernization of Higher Education in Europe](#)

[2nd part: e-learning and digital learning: current perspectives](#)

[3rd part: What can we do?](#)

Actual Guidelines



Project within H2020 led by ENEN: ANNETTE

- The aim of these courses is to strengthen the required competences for achieving excellence in Nuclear Safety Culture
- Production of a specialized modular MOOC focused on Nuclear Safety Culture
- Materials will be elaborated in collaboration with TECNATOM



**ANNETTE WP5,
e-learning and OPEN
education**

Work Package 5:

ETI Actions related to Nuclear Safety Culture

- To provide the knowledge, skills and attitudes necessary to value safety as the most important aspect in nuclear activities.
- **Production of MOOCs on nuclear safety culture** which will have the objective to disseminate the contents of selected courses, thus reaching a wider public.

ANNETTE: WP5

UNED & Tecnatom contribution

A **MOOC** in Nuclear Safety Culture



UNED participation in ANNETTE WP5

- **Training for MOOC development** (curators and facilitators)
- **Methodological and technical assistant** on MOOC contents, activities and assessment elaboration
- **MOOC hosting and facilitation**
- **MOOC accreditation design and quality assurance**

UNED participation in ANNETTE WP5

1. Training ANNETTE members involved in MOOCs development in OER / MOOC methodology: **A MOOC-style course to design a MOOC**

I. *Current basis of online teaching and learning methodology*

- Current trends in HE training and e-learning support
- Enriched learning environments mediated by technologies: new E&T scenarios
- The role of OER and MOOCs in HE

II. *How to design a MOOC*

- Selection of MOOC type
- Competences and Learning objectives
- MOOC structure: Modules
- Orientations and guidelines
- Learning materials I: videos for MOOCs
- Learning materials II: Searching and elaborating other multimedia materials
- Learning activities, both individual and collaborative ones
- Online evaluation: self-evaluation, online exams, peer-to-peer- evaluation
- Badges and MOOC accreditation and certification alternatives
- Participants' support roles: curators and facilitators

- 2. Technical assistance for MOOC implementation and start-up in the MOOC platform**
- 3. Training of ANNETTE members involved in the MOOCs to make use of the MOOC platform and its tools**
- 4. Design of ANNETTE MOOCs' accreditation and certification system**
- 5. Implementation of ANNETTE MOOCs quality assurance system and evaluation under OpenUpEd benchmarks** (OpenUpEd is the first, and, thus far, the only pan-European MOOC initiative. It was launched in April 2013 by EADTU in collaboration with the European Commission)

Fukushima Accident OCW to evolve to a MOOC

- A dissemination course about Fukushima Dai-ichi accident in OCW and MOOC versions.
- The objective of this course is to provide relevant information about the accident to the general public, explaining each event, the international reaction as well as the lessons learned
- Any person could take the Fukushima Accident course, since it does not have any specific requirement
- Also, additional materials will be available for any student with a technical or specialized background in order to make the course more interesting for them

PLATFORMS



ANDROID



iOS



edX

Motivation

- The great impact of Fukushima Dai-ichi accident in public opinion and in the media

- ➔ The information given in the media is not precise
- ➔ Information is sometimes polarised

The dissemination of nuclear knowledge in a mainstream environment to deal with the nuclear phobia



Course objectives (I)

To deliver the most relevant information about the accident:

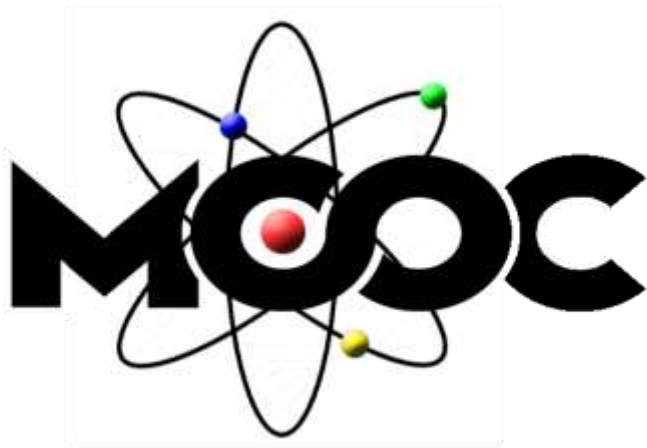
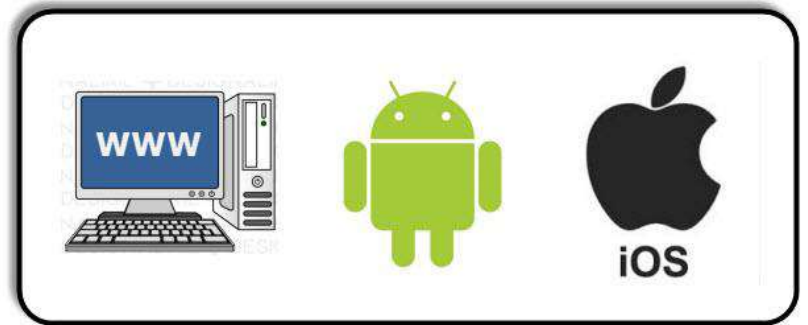
- ✓ Giving a context to the accident
- ✓ Explaining each of its phase
- ✓ International reactions
- ✓ Lessons learned



- To reach the biggest possible audience:

- ✓ Without previous requisites
- ✓ Interesting also for technical or specialised personnel

Course objectives (II)

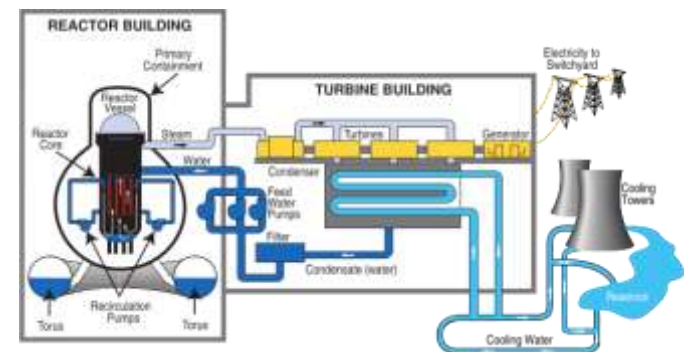
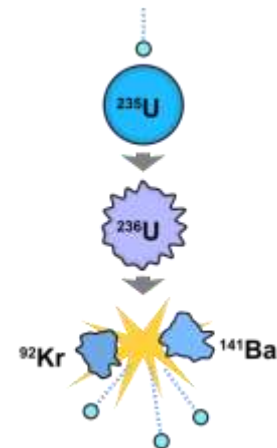


Course Contents (I)

Unidad Didáctica 1: La energía nuclear. Centrales

Unidad Didáctica 2: Contexto y antecedentes

Unidad Didáctica 3: El accidente nuclear



Course Contents (II)



Unidad Didáctica 4: Consecuencias radiológicas y medias de protección.

Unidad Didáctica 5: Recuperación tras el accidente



Unidad Didáctica 6: Impacto del accidente y lecciones aprendidas

Course Structure

- Modular structure with 6 thematic units
- Study guide
- Initial and final survey
- In each thematic module:
 - ✓ Mini-Videos
 - ✓ Reference reading material
 - ✓ Complementary Material
 - ✓ Auto evaluation questionnaire



Course Structure



- The learning process is adapted to ones path
- Recommendation: 1 week for each thematic module (6 weeks)
 - Estimation of 1 credit ECTS (25-30 working hours of the participant)

- Possibility of UNED certification
- Exams with identity accreditation may be taken at national and international UNED Associated Centres



Previous Pilot test experience for a first evaluation of the OCW course

- **UNED's Program of research networks for education innovation**
"Redes de Investigación para innovación docente"

- ✓ Students of the subject: Basics on Nuclear Engineering in the degrees:

- Ingeniería en Tecnologías industriales
- Ingeniería Mecánica
- Ingeniería Eléctrica

- ✓ Voluntary participation

- ✓ 1.5 additional ECTS credits

Objective of the evaluation

- ✓ Testing the contents of the open online course

- ✓ Development of new material in a collaborative way

- ✓ Some optional more technical contents

- ✓ Look for errors in the media regarding the accident to explain the facts in the correct way

- ✓ Evaluate for the nuclear engineering students:

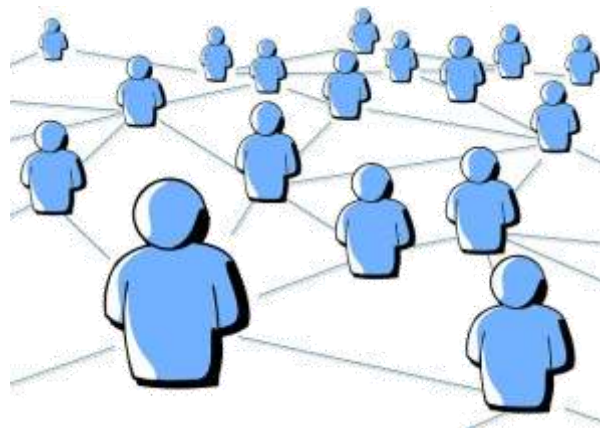
- Horizontal competences
- The assimilation of the contents
- The motivation generated



Conclusions (I)

An objective view of the subject by means of an open educational resource following MOOC philosophy

- The use of new tools and methodologies for education allow :
 - ✓ A valuable contribution for the general public
 - ✓ An excellent starting point to strengthen links between experts
 - ✓ Encouraging the creation and co-creation of educational materials



Conclusions (II)

- We are searching for partners who want to participate in the production of a future MOOC
- We invite experts to collaborate in the testing of the contents that will be developed during the course evaluation process



[Access to Fukushima OCW course](#)

A pilot international online course on nuclear waste transmutation to be implemented and tested on a subject of UNED's Master in Industrial Engineering

- The main objective is to test the pilot online course in a University related subject, as well as to improve the course evaluation methodologies to assess this experience.



Activities	Duration
Watching videos and studying their PowerPoint presentations	15 hours
Studying additional materials	10 hours
Studying simulations and doing simulation tasks	5 hours
Forum participation	2 hours
Web conferencing assistance	4 hours
Final exam	1 hour

Tab 2. Course Activities within the Industrial Engineering Master subject

Knowledge Management Course for Nuclear Organizations

- An online course to develop the skills in the knowledge direction and management in the context of the nuclear sector organizations.
- The target group of the course are professionals from the nuclear organizations interested in organizational issues and, mainly, those ones of this sector who require flexible continuing education
- The active participation in the learning process via the forums is key in the course

- **Study Guide**

In each thematic module:

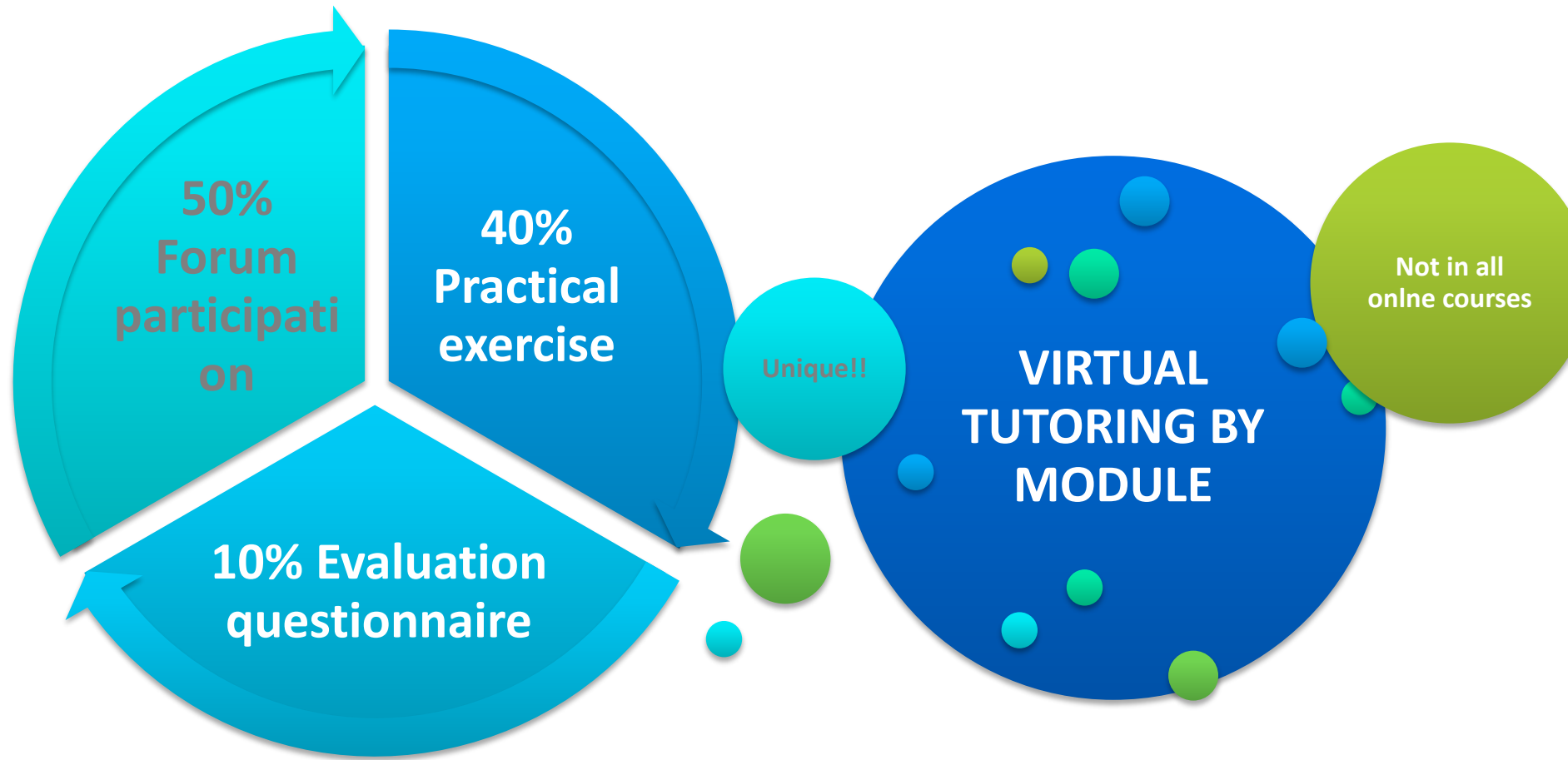
- **Introductory video**
A first contact with the module subject with a nearer contact to the teacher
<https://canal.uned.es/mmobj/index/id/45849>
- **Video by an expert from the nuclear sector**
To know the real experience in relation with the subject of the module
 - <https://canal.uned.es/mmobj/index/id/46501> (interview to Mikko Merikari STUK Regulatory body Finland, in english)
 - <https://canal.uned.es/mmobj/index/id/46499> (interview to Didier Louvat Director of ENSTTI international nuclear training organization, in spanish)
- **Readings (module material)**
Tuned to what the nuclear sector need to know
- **Forum (specific questions)**
Centred in important subjects, so the readings can guide profound reflexions
- **Exercise (sequentially linked between the 4 modules)**
At the end of the course this part in the different modules will configure a global exercise
- **Evaluation test (reinforcing)**
To go over the key concepts

MATERIALS AND COMMUNICATION TOOLS

Additionally, we have special tools for online courses:

- **UNED aLF Learning Management System, with all its functionalities (MOODLE type)**
- **Additional networking resources: Blog, video channel (community)**
 - ✓ **Video channel:** to have a reference of all the knowledge videos that we are generating in the course
 - ✓ **A place for all the community interested in NKM**
 - The interested people who have made the course may keep connected
 - The interested people who are going to follow the course
 - All those interested in NKM

MATERIALS AND COMMUNICATION TOOLS



EVALUATION AND TUTORING ACTIVITIES

CURSO DE GESTIÓN DEL CONOCIMIENTO EN ORGANIZACIONES DEL SECTOR NUCLEAR



OBJETIVO

Crear competencias en la dirección y gestión del conocimiento tanto desde el plano de la estrategia como de la operación específica dentro del contexto de las organizaciones del sector nuclear.

CONTENIDOS

1. El valor del conocimiento en las organizaciones del sector nuclear.

2. Los activos intangibles: El capital intelectual en las organizaciones del sector nuclear.

3. Modelo y estrategias de Gestión del Conocimiento para las organizaciones del sector nuclear.

4. Competencias para la Gestión del Conocimiento.



El coste son 180€ y para matricularse hay que acceder a través de Formación Permanente de la UNED. La matrícula se puede hacer desde ya, hasta el 13 de Enero de 2016.

El curso comienza el 18 de enero de 2016 y dura hasta el 15 de abril de 2016, con 5 créditos ECTS equivalentes a 125 horas de trabajo del participante.



http://formacionpermanente.uned.es/tp_actividad/id_actividad/8723



malonso@ind.uned.es

- The only university course on KNM in Spanish
- **Innovation in nuclear education with the use of ICT**
 - Flexibility
 - Active and participative learning
 - Networking
- **Practical for every organization**
- The implementation of NKM initiatives as a business objective

We try to generate a better situation regarding NKM in the nuclear sector



GESTIÓN DEL CONOCIMIENTO

[Access to UNED webpage](#)

[Access to the course learning platform](#)

[Access to the course open blog](#)

[Access to the open UNED Chanel with the course videos](#)

Open database with the main available online open nuclear engineering educational resources

- A database including all nuclear online open courses worldwide, in English language, to provide guidance for the interested public.
- New tools and methodologies, like Data Mining, Semantic Web, are being evaluated to create this metadata indexed catalogue in the near future.





IN-CLOUD

Innovation in Universities and Businesses

Erasmus+ Strategic Partnership n° 2015-1-IT01-KA202-00473

DIEEC (Electrical and Computer Engineering Department)
UNED (Spanish University for Distance Education)



Manuel Castro (UNED)
Sergio Martín (UNED)
Mercedes Alonso-Ramos (UNED)
María José Albert (UNED)
Belen Moriñigo (UNED)



A methodology for the recording of videos in Computer Science MOOCs

1. *The initial standpoint*

- The learning outcomes. What is the use of a video in a MOOC?
- What material resources and other means we have?
- The profile of the person recording the video regarding
 - Instructional design knowledge
 - Audio-visual production knowledge
 - Body language and voice awareness. How is your character?
 - Motivation, etc.
 - ***The design of the narrative structure. What do I want to explain?***

2. *The script*

- Means, tools and techniques to use
- A stop in the way for creativity and to enhance motivation. The personal input
- Harmonizing the script with the tools

1. *The recording of the video*

- Do I need to be an actor to make a good video for a MOOC?
- Timing and iteration
- Rehearse and rehearse to be able to improvise
- I try to find someone to look at me
- First recording
 - The place and the position
 - One or more persons
 - The interview format
 - Lighting
 - The background
- Feedback. Are the learning outcomes achieved?
- Repeat if needed. Take care to keep fresh!

Annexes to the Guide: depending on the profile of the “producer”

Conclusions and future work (I)

- A contribution to a new educational approach in nuclear engineering in order to encourage other organizations to shift the traditional paradigm, and to innovate their teaching and learning methodologies, as done in many other knowledge fields, by incorporating online programs and different educational proposals based on the use of OER.
- These new proposals go in the direction of reducing ETI activities costs, specially difficult and expensive in the case of some nuclear engineering topics, usually taught in face-to-face sessions. They also allow the growth of dissemination activities among the society.
- Regarding bringing the general public closer to nuclear knowledge, OCW and MOOCs proposals are an excellent option thanks to their massive nature and cost effectiveness, and the flexibility that allows society to make compatible family and work responsibilities with achieving a reliable information and education in nuclear fields.
- These new teaching and learning methodologies are not only making significant contributions for the general public, but also they may become an excellent platform for networking activities to strengthen the links among expert personnel in different topics of study, and to enhance the education and the communication for the creation and co-creation of educational materials.

Conclusions and future work (II)

- These research guidelines encourage an open collaborative spirit. The spirit of listening follows the win-to-win theory. They are an ingredient for the change within the nuclear sector, enhancing the transparency, the communication, the ability to listen to criticism, etc., in order to establish a change in the communication in between stakeholders, and between the general public and the experts. This contributes to enhance nuclear safety culture, which is in the core of the sustainability of nuclear energy and the nuclear sector .
- Connected to these previous opportunities, the innovative concept of co-creation of contents through online collaborative tools, and the experience of nuclear engineering students participating in this kind of proposals, allow presenting the production of new contents as a new educational trend in the field.
- Finally, testing these activities by the students is also a new idea to apply to nuclear engineering education. With the integration of collaborative tools and methodologies as “pilot experiences” within regular courses, a wide search on open educational resources can be done in a reliable and complete way, likely increasing students’ motivation and engagement with their studies.

Conclusions and future work

(III)

Innovative scenarios applied to education in a specialized, complex and no massive area of knowledge, such as nuclear engineering, are clearly necessary. In this sense, we agree with OPEN UK experts' recent report with the idea that *“Social learning is not just a means of sharing learning resources, but a valuable activity in itself. Learning together creates a ‘shared mind’ that combines different perspectives and alternative ways to solve problems”* (Sharples et al, 2014), a relevant issue facing XXI century difficulties and challenges in the nuclear

Open video of the presentation:

["Sustainable education in nuclear engineering in a changing world:](#)

The role of open education (as MOOCs) and blended learning”

Thank you so much!!

