

DE LA RECHERCHE À L'INDUSTRIE



FP7 / 2007-2013 n ° 605159

EXPÉRIENCE ENETRAP III

FORMATION DES FORMATEURS RADIOPROTECTION

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- ENETRAP I, II ET III
- WP4 : LA FORMATION DES FORMATEURS
- MISE EN ŒUVRE
- PERSPECTIVES ET CONCLUSION



SCK-CEN

+ 9

CEA/INSTN

FZK-FTU

BfS

CIEMAT

NRG

ENEA

HPA-RPD

UJF Grenoble

NHC Scotland

- Établissement d'un consortium d'universités (4) → lancement Master Européen de radioprotection EMRP
- Questionnaire ENETRAP
 - ✓ Nombre de RPO et RPE
 - ✓ Identification des pratiques
 - ✓ Capacités nationales pour E&T en RP
 - ✓ Exigences réglementaires
 - ✓ Processus de reconnaissance
- "ENETRAP training scheme" préliminaire
- Développement de module e-learning (Moodle)
- Conseil sur la mise en œuvre de formation sur le terrain pour les travailleurs exposés
- Développement de la plateforme européenne EUTERP supportée par les utilisateurs finaux et les organismes de formation



SCK-CEN

+ 11

CEA/INSTN

KIT

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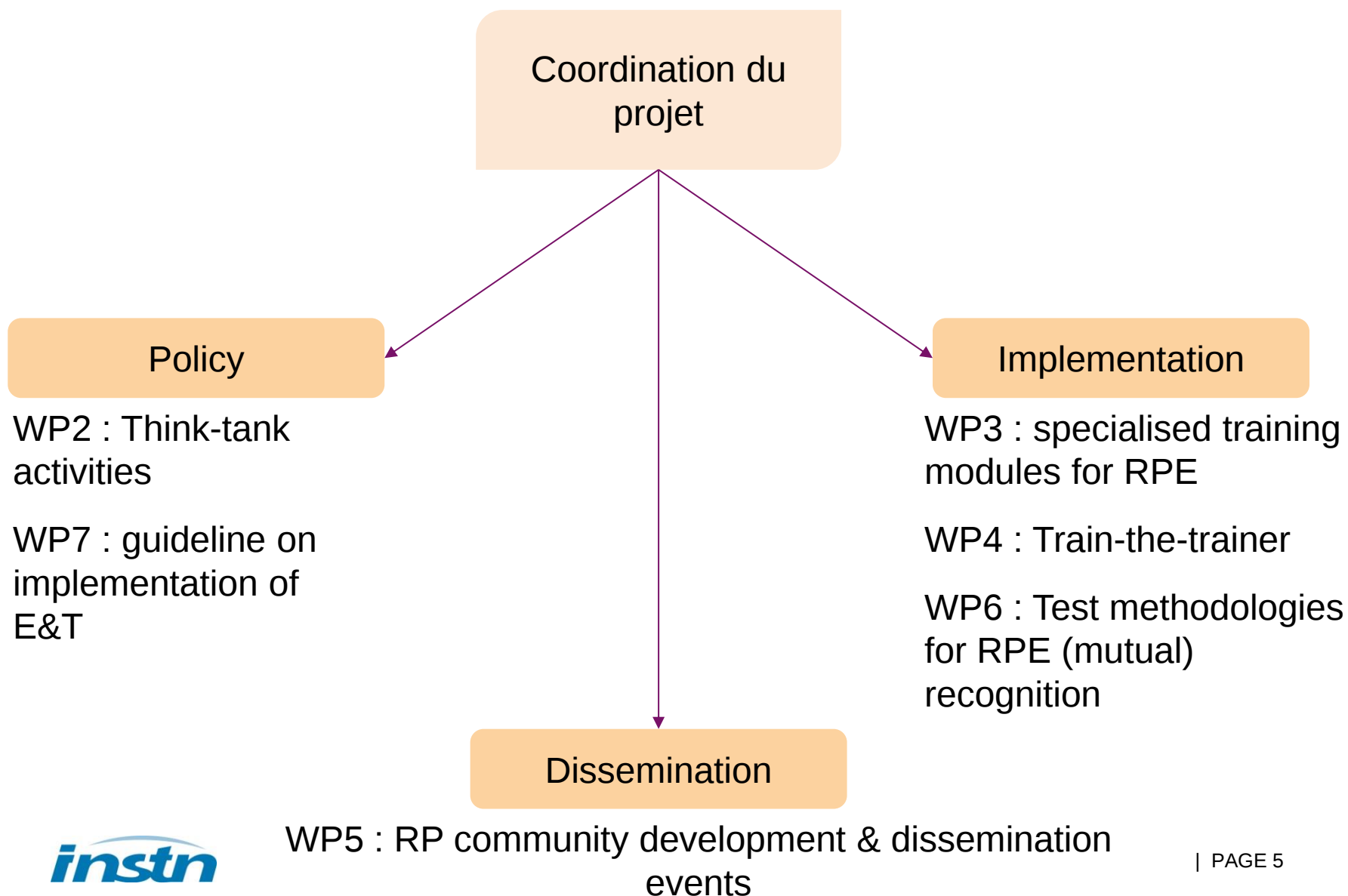
ENEN

ITN

BME

UPB

- Principalement pour RPE et RPO, mais inclus également les approches utilisées pour les MPE
- Élaboration d'un programme de formation européen de référence pour le RPE comme base pour la reconnaissance mutuelle
- L'introduction de l'approche ECVET, des résultats d'apprentissage en termes de K / S / Compétence
- Organisation de sessions pilotes
- Réflexion sur les cadres et les méthodes de reconnaissance nationale et internationale des RPE
- Pour garantir des résultats durables, renforcement des liens avec EUTERP et HERCA



WP4 : LA FORMATION DE FORMATEURS

Work package description

Project Number ¹	605159	Project Acronym ²	ENETRAP III
One form per Work Package			
Work package number ³	WP4	Type of activity ⁴	COORD
Work package title	Development of a train-the-trainer (TTT) strategy and organisation of a TTT training event		
Start month	1		
End month	30		
Lead beneficiary number ⁵	4		
Objectives			
It is the objective of the WP to develop a train-the-trainer strategy that will, along with other aspects, promote the ECVET concept. In this way ENETRAP III aims for a sustainable implementation of the most recent didactic methods in a harmonized way throughout current and future training courses in radiation protection (and other nuclear topics), facilitating good practices in training course development and implementation. Pilot sessions will be organised and evaluated. The ENEN Association will be addressed to recognise the course within their system and the course will be made available to training providers in other domains such as nuclear engineering, waste management and low dose research.			
Description of work and role of partners			
Until now, E&T projects focused mainly on the development of technical and scientific modules related to the required nuclear knowledge and skills. Little consideration has been given to those providing training but, clearly, one of the key factors in ensuring qualitative high-level training is the suitability of providers. Also for them, the appropriate knowledge, skills and competences need to be available and they need to have a high-level understanding of the scientific and technical basis they are training, but also an insight in the context and a sense for the social and philosophical aspects of the situation, and appropriate didactic skills. An understanding of the existing credit and qualification systems like ECTS, EQF, EQAVET and ECVET is also very relevant. In addition, they must be able to develop "learning outcomes" for all new topics they will teach. Last but not least, the developments will give attention to the challenges involved in teaching difficult scientific and technical topics that have a significant societal impact and for which relevant ethical issues can be raised. It is the objective of this work package to develop a strategy for the development of trainers - a "train-the-trainers (TTT)" approach - that will, along with other aspects, promote the ECVET concept. In this way ENETRAP III aims for a sustainable implementation of the most recent didactic methods in a harmonized way throughout current and future training courses in radiation protection (and other nuclear topics), facilitating good practices in training course development and implementation. Particular emphasis will be made on the use of teaching strategies adapted to different teaching modalities (from face-to-face to b-learning). Using a Learning Management System for the management of training resources will be presented. In addition, participants will learn how to create and manage multimedia resources suitable for courses that they teach. After developing the strategy, which is envisaged to include the identification of trainer pre-requisites, the development of the content of a specific TTT package/event and associated training material will be done, and one pilot event will be organised of which the effectiveness will be evaluated. When needed, the content will be revised taking into account the feedback received from the pilot session. To obtain the highest quality, ENETRAP III might address towards experts in the field of didactics and the development of European Quality and Credit Systems in E&T, for example, experts from the national ECVET teams. They might be invited to teach in the pilot sessions. In the last phase of this WP, the TTT will be made available to the ENEN Association for recognition within their system. Although developed in the framework of radiation protection training, this TTT will be also of use to training providers in other domains such as nuclear engineering, waste management and low dose research.			

DESCRIPTION WP4

- Élaborer une stratégie de formation des formateurs cette volonté, ainsi que d'autres aspects, **promouvoir le concept ECVET (1)**
- De cette façon ENETRAP III vise une mise en œuvre durable de la **la plupart des méthodes didactiques récentes (2)** d'une manière harmonisée dans les cours actuels et futurs de formation en radioprotection (et d'autres sujets nucléaires), **faciliter les bonnes pratiques en cours de formation (3)** le développement et la mise en œuvre.
- session pilote sera **organisée (4)** et **évaluée (5)**.
- L'Association ENEN **reconnaîtra (6)** le cours dans leur système et le cours **sera mis à la disposition des prestataires de formation dans d'autres domaines (7)** tels que l'ingénierie nucléaire, la gestion des déchets et de la recherche à faible dose.

PROFIL DU FORMATEUR RPO / RPE

■ Basé sur les profils EHRO-N



Qualification: RPE Trainer

EQF Level 5-6

The RPE trainer should have soft skills in following domains, in addition to competences in radiation protection.

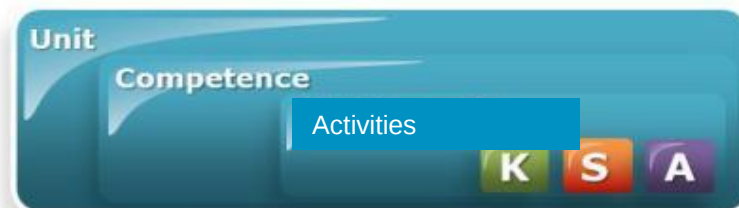
List of units of learning outcomes/ULOs:

1.	Pedagogic / andragogic skills
2.	Organisation of training events
3.	Listening and adaptability to audience
4.	Using innovative tools
5.	Group and project management

Unit of learning outcomes #1: PEDAGOGIC / ANDRAGOGIC SKILLS

Skills	Competences/Attitudes	Knowledge
S.1.1. Define pedagogy and andragogy terms	C.1.1. Adapt learning strategy to audience	K.1.1. Concept of pedagogy and andragogy
S.1.2. Be able to transmit his/her knowledge	C.1.2. Succeed to transmit information	K.1.2. Transmission scheme: transmitter - receiver
S.1.4.a. Listen to customer needs S.1.4.b. Manage actions	C1.4. Organise a training course including requirements specification	K.1.4. Organisation of training course
To be enrich during training as an	To be enrich during training as an	To be enrich during training as an

Exercice



EXEMPLE DE DESCRIPTION DE PROFIL EHRO-N - JRC

Ref	Job Title	Occupational Category
2.5.02	Chemical Supervisor	Professional
Phase / Area	Alternate job title(s) – specialisations	Functional Category
NPP 0	-----	---
Chemistry	-----	---
Role / Functions		
Control and optimization of NPP fluids chemical regime, Control of nuclear equipment corrosion and tests and analysis of applied chemical reagents and consumables		
- Organize and lead the analysis and control of chemical conditions/regime of the coolant and other technological flows/fluids during operation and maintenance - Monitor and control solid residuals and liquid and gaseous releases during operation - Prepare and supervise the implementation of programs or/and procedures for chemical control, chemical testing, chemical rinse-out and other subject matter technological activities - Monitoring and assessment of NPP fluids chemical regime - Monitoring and assessment of nuclear equipment corrosion - Organize and lead the process of decontamination and conservation of the equipment during outage or long-term layover - Supervise the validation of methods for analytical testing and calibration - Review event analysis report on events related to chemical equipment or metal corrosion conditions - Training programmes for chemistry workers - Team and technical supervision		
Qualification structure (ECVET approach)		
ECVET REQUIREMENTS:		
- Learning Unit/LU- The smallest part of a qualification that can be assessed, transferred, validated and, possibly, certified. - LU titles linked with Chemistry Supervisor Role/Functions (from JD 2.5.02) - Learning Outcome/LO- a competence necessary to exercise a particular LU of the job JD- Chemistry Supervisor _2.5.02 - could be the LO assessed and evaluated? - K, S and C/A defined using the proper action verbs (Bloom taxonomy)?		
LU 1: Chemical regime of NPP's fluids during operation and maintenance LO 1.1 NPP phenomena that influence chemical regime of fluids /6 LO 1.2 NPP's equipment corrosion/6 LO 1.3 Solid and liquid residuals and gaseous releases/6 LU 2: Programs and procedures for chemical control, testing and chemical rinse-out 2.1 Monitoring and assessment of NPP fluids chemical regime/6 2.2 Monitoring and assessment of nuclear equipment corrosion/6 2.3 Decontamination and conservation of the equipment during outage or long-term layover/6 LU 3: Review event analysis report 3.1 NPP systems and components/5 3.2 Events related to chemical equipment/6 3.3 Events related to metal corrosion conditions/6 LU 4: Training programmes for chemistry workers 4.1 Team and technical supervision/6 4.2 Input for ChW refreshments-at each 6 months/6 4.3 Radiation protection and emergency response/5		
JOB REQUIREMENTS		
K no.	KNOWLEDGE (Cognitive competence)	EQF level (1-8)
K 1.1	- Describe the physical and chemical phenomena that influence fluid's chemical regime/EQF 5 - Demonstrate the customization for NPP of chemical engineering methods for control fluid's chemical regime - Predict the effects of fluids' chemical regime over nuclear equipment/ EQF 6 - Organize the analysis and control of chemical regime of the	6

European Commission

NPP's fluids/EQF 6		
K 1.2	- Describe the effects of water/chemical reagents and metal /EQF 5 - Assess the corrosion effects on nuclear equipment/6 - Select the suitable methods for corrosion protection/EQF 6	6
K 1.3	- Identify the physical/nuclear and chemical phenomena that generate solid and liquid residuals and gaseous releases /EQF 6 - Evaluate the amount of solid and liquid residuals and gaseous releases / EQF 5 - Organize the system of solid and liquid residuals and gaseous releases /EQF 5	5

K 3.1	- Recall and outline the chain of energy transformations in NPP/EQF 6 - Describe the main systems of NPP (1st loop/ Primary Heat Transport System, 2nd loop/ power circuit, Nuclear security system)/ EQF 6 - Describe the key components of NPP (Nuclear Reactor; Steam generators; pumps; heat exchangers; etc.) /EQF 5 - Identify construction materials for nuclear equipment/ EQF 4	5
S no.	SKILLS (Technical and functional competence)	EQF level (1-8)
S 1.1	- Perform-autonomously the control of chemical regime of the NPP's fluids /EQF 6 - Adapt the methods of controlling the chemical regime of the NPP's fluids / EQF 5 - Providing input for the Review event analysis report / EQF 6	6
S 1.2	- Develop specific methods for nuclear equipment corrosion protection /EQF 6 - Implement the nuclear equipment corrosion protection program / EQF 5 - Cooperate with other departments for the nuclear equipment corrosion protection program implementation/EQF 6	6
S 1.3	- Alter (when necessary) the system of solid and liquid residuals and gaseous releases /EQF 6 - Coordinate the operation of the system of solid and liquid residuals and gaseous releases / EQF 5	6

S 3.1	- Prepare the nuclear equipment for maintenance and tests/EQF 6 - Using and interpreting engineering data and documentation/ EQF 5 - Providing input for the draft of requirements specifications/ EQF 4	5
C/A no.	COMPETENCE (Attitude; behavioural and personal competence)	EQF level (1-8)
C/A 1.1-1.3	- Analytical thinking and inside/ EQF 6 - Communication - capacity to communicate technical or specialized information / EQF 4 - Eye for detail / accuracy / EQF 5	5

PROGRAMME DE LA FORMATION

	Monday	Tuesday	Wednesday	Thursday	Friday
09:00	Introduction to TTT course	Teaching techniques: from lecture to case studies	Software for dose calculation: how to create exercises?	To be completed (Detection practical work e.g.)	Preparation work before training action with RP audience
10:00	Presentation of course objectives and program	Introduction to innovative tools			Training action with RP audience: - several workshops and groups of learners
	Tour de table	How to enhance learner participation?	Augmented virtual reality in medical sector: VRT presentation	<i>Pratique</i>	<i>Pratique</i>
11:00	ECVET system: how to implement it	Simulation tools			
12:00	Lunch	Lunch	Lunch	Lunch	Lunch
13:00	ECVET and RP job profiles	NPP work-school workshop	DOSEO workshop: medical sector	Preparation work before training action in front of RP audience	Training action with RP audience: - several workshops and groups of learners
14:00	Workshop: From job profiles to learning outcomes	<i>Pratique</i>	<i>Pratique</i>		<i>Pratique</i>
15:00	ECVET: from Learning Outcomes to E&T content				Conclusion and debriefing of ENETRAP TTT course
16:00	Discussion on ECVET implementation				

FICHE DESCRIPTIVE PAR SEQUENCE

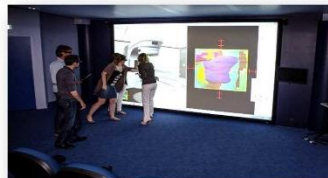
[Sequence 12] 3D SIMULATION IN MEDICAL SECTOR: PRESENTATION OF TRAINING SCENARI DEVELOPPED FOR “VERT” EQUIPEMENT

PRESENTATION

1. General objective of the sequence

Expérimenter la simulation 3D dans le domaine de la radioprotection du patient.

Discuter autour de l'élaboration de scénarii pédagogiques



2. Learning outcomes

- Prendre connaissance des outils de simulation 3D existant dans le domaine de la radioprotection médicale
- Visualiser le faisceau d'irradiation
- Visualiser les volumes irradiés
- Quantifier le rayonnement diffusé
- Identifier les équipements de protection individuels pouvant être mis en œuvre

3. Prerequisite

The course is suitable for radiation protection professionals in all sectors and he/she shall be working in a training provider organisation in radiation protection.

Participant should be very familiar with the role and duties of the Radiation Protection Expert and Radiation Protection Officer. He/she is expected to become a trainer of Radiation Protection Expert and/or Officer in his/her country.

4. Table: Knowledge / Skills / Attitude

12.1	Prendre connaissance des outils de simulation 3D existant dans le domaine de la radioprotection médicale
KNOWLEDGE	
K 12.1.1	Lister les différents types d'équipement à visées pédagogiques
K 12.1.2	Décrire le principe de fonctionnement
K 12.1.3	Identifier les utilisations possibles
SKILLS	
S 12.1.1	Manipuler la tête d'irradiation virtuellement
ATTITUDE	
A 12.1.1	Observer les mouvements du modèle humain (fantôme)
12.2	Visualiser le faisceau d'irradiation
KNOWLEDGE	
K 12.2.1	Identifier rayonnement direct
K 12.2.2	Identifier rayonnement diffusé
SKILLS	
S 12.2.1	Suivre le parcours du faisceau incident
S 12.2.2	Proposer différents angles d'incidence et visualiser les résultats
S 12.2.3	Effectuer ou faire réaliser les rotations de la tête
ATTITUDE	
12.3	Visualiser les volumes irradiés
KNOWLEDGE	
K 12.3.1	Définir ce qu'est le volume irradié
K 12.3.2	Expliquer les différents volumes irradiés en fonction des couleurs des organes
SKILLS	
S 12.3.1	Localiser sur le fantôme le volume irradié
S 12.3.2	Localiser sur le fantôme les volumes adjacents et les doses efficaces associées
ATTITUDE	
12.4	Quantifier le rayonnement diffusé
KNOWLEDGE	

ASPECTS ANDRAGOGIQUES

- Andragogie se compose de stratégies d'enseignement axées sur les adultes. Elle est souvent interprétée comme le processus d'engagement des apprenants adultes dans une expérience d'apprentissage.
- Le processus d'apprentissage doit **être adapté au public**
- Les apprenants ont **besoin de savoir pourquoi** ils ont besoin d'apprendre quelque chose avant d'entreprendre la formation
- Les adultes ont la **volonté** d'apprendre si les nouvelles connaissances et compétences leur permettent de **mieux faire face à des situations réelles** qu'ils vivent
- Les adultes sont sensibles à des pressions internes qui constituent des grands **ressorts motivationnels** (le désir d'augmenter la satisfaction au travail, l'estime de soi..)

LES TECHNIQUES PÉDAGOGIQUES

Quelques techniques au service du formateur
→ vers un "mix pédagogique"



MODÈLE D'ÉVALUATION DE LA FORMATION DE KIRKPATRICK

ÉVALUATION DE PLUS EN PLUS FINE ET RIGOUREUSE



Reaction – Learning – Behaviour – Results – (ROE)

LES PRINCIPAUX OUTILS

Ordinateur / e-device

Tableau noir / blanc / papier / interactif

Immersion / 360°

Supports écrits

Jeux pédagogiques



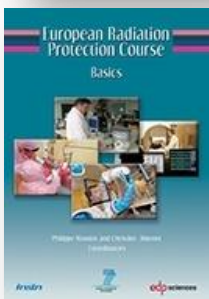
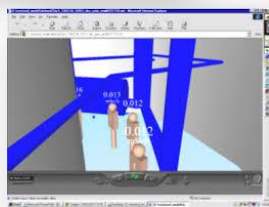
Outils spécifiques liés
à la thématique enseignée

Audio / vidéo

Système de vote

PROPOSITION D'ACTIVITÉS POUR LA FORMATION DES FORMATEURS

DES OUTILS DE FORMATION



■ Simulation

■ Logiciel pour la mise en œuvre d'ALARA

■ Ateliers pratique : NPP et medical

■ Metaplan®, SWOT, livres...

■ La réalité augmentée

■ Système de vote

LES OUTILS INFORMATIQUES ET LES OUTILS LUDIQUES

■ ORDINATEUR utilisé comme :

- ✓ Outil de création de ressources pédagogiques et d'organisation des contenus CMS → LMS mais attention au détournement d'usage
- ✓ Ressources pédagogiques : e-learning, b-learning, m-learning,
- ✓ MOOC, SPOOC,
- ✓ RapidLearning, vidéo-PPT synchronisé, "Just in Time learning" (grain de connaissance), résolution de problèmes,
- ✓ Réalité augmentée, réalité virtuelle (immersif et 360°)
- ✓ ... Et bien d'autres à inventer, expérimenter

■ JEUX PÉDAGOGIQUES

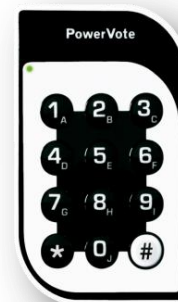
- ✓ Jeu de cartes et jeu de plateau → collaboratif, co-construction
- ✓ Plateformes multimodales (tablettes, smartphones, ...) où le jeu pédagogique s'appuie sur la fibre ludique des participants, permettant ainsi d'introduire de l'interactivité et de stimuler le travail collaboratif
- ✓ Système de vote pour l'évaluation formative et sommative

■ Stimule les participants durant la formation

- ✓ Caractère innovant et ludique
- ✓ Permet de poser des questions ouvertes ou fermées
- ✓ Les diapositives de vote sont à répartir tout au long de la formation
- ✓ Permet à la fin d'obtenir un podium nominatif ou anonyme

■ Des solutions gratuites existent

- ✓ Sans boîtier
- ✓ À partir de smartphones
- ✓ Nécessite une connexion réseau ou via une box dans la salle
- ✓ Par exemple : www.arsnova.eu



PERSPECTIVES ET CONCLUSIONS

■ La formation de formateurs doit promouvoir des approches pédagogiques/andragogiques adaptées :

- ✓ Au public (générations sociologiques X, Y et Z)
- ✓ A la culture européenne, voire internationale

■ Approche ECVET à mettre en œuvre

- ✓ Les résultats d'apprentissage comme "pilotes" de l'action de formation
- ✓ Les descripteurs K - S – A/C à utiliser avec les niveaux EQF
- ✓ → Formation pilotée par des compétences et non plus par des contenus

■ Mobilité intra européenne, voire internationale

■ La formation peut être un facteur discriminant pour des marches à l'export

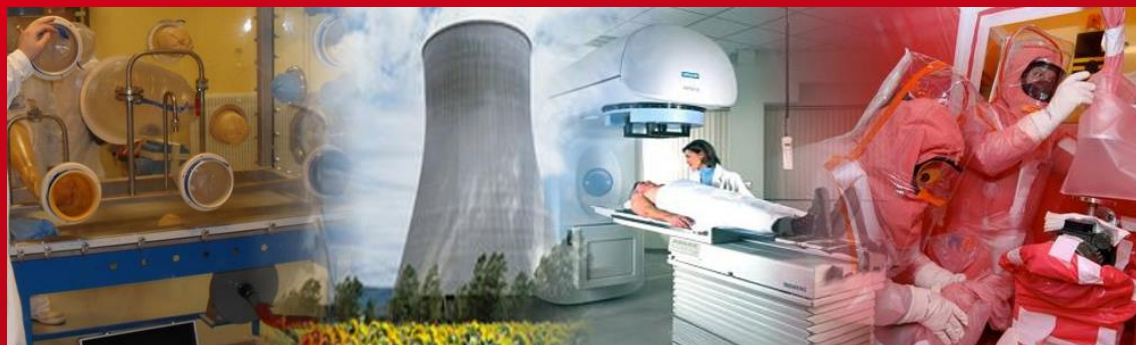
Mars 2016 : INSTN nommé 1^{er} Collaborating Center de l'AIEA en France

"Education and training in Nuclear Technologies, Industrial and Radiopharmaceutical Applications"



**Merci pour
votre
attention!!**

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L'ÉNERGIE ATOMIQUE ET AUX ÉNERGIES ALTERNATIVES COMMISSION

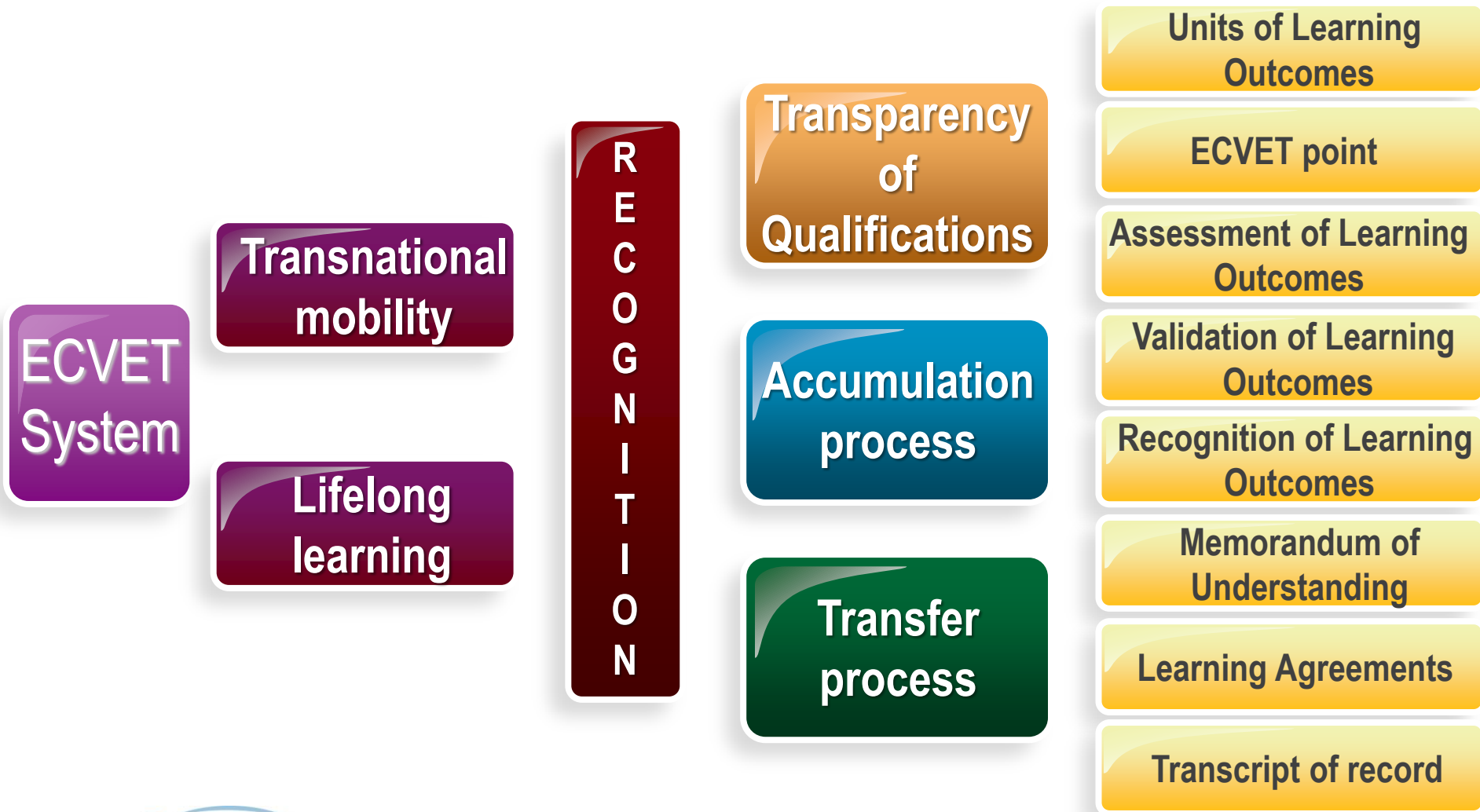
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DES EXEMPLES DE JEUX PÉDAGOGIQUES

