Teaching about biological effects of ionizing radiation, a sensitive societal issue related to radiation protection

Marie-Hélène Hengé-Napoli

Institut National des Sciences et Techniques Nucléaires (France)

Nicolas Lechopier

Département Sciences et Société ENS Lyon –(France)

2nd INTERNATIONAL SYMPOSIUM

Ethics of Environmental Health

15 -19 June 2014 – Czech Republic

LEARNERS

It is the employer who must meet the legal requirement to have trained personnel at the workplace.

- **Occupational training**: mandatory training to be allowed to work in nuclear facilities
- Training for lifelong learning

G1 Reactor dismantling

- **Students** involved in University degree courses

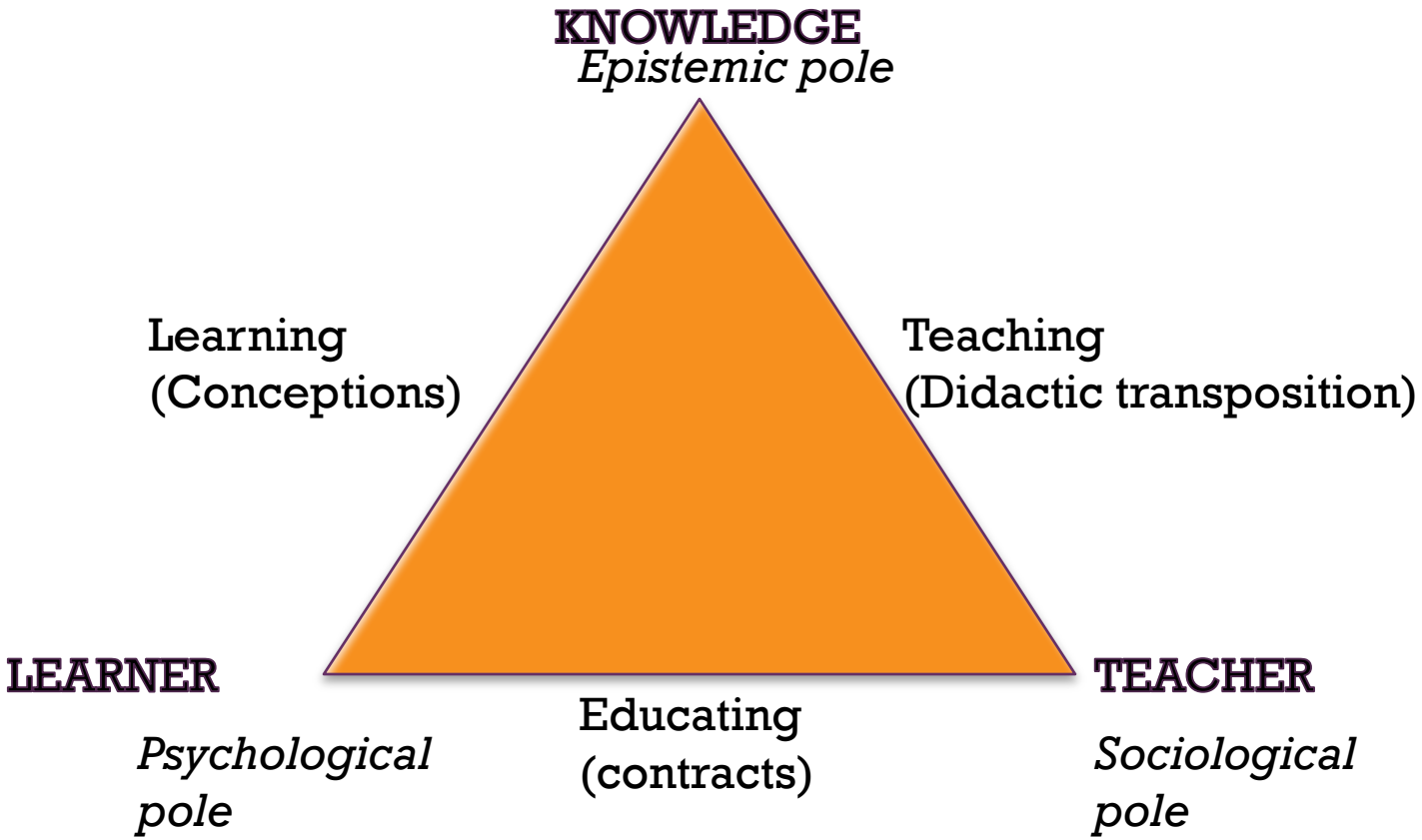
The objective is to move them from the non informed person position to a first level of expertise

TEACHING THE BIOLOGICAL EFFECTS OF IONISING RADIATIONS

- Training in radiation protection always includes an introduction of the basis of the biological effects of ionizing radiation

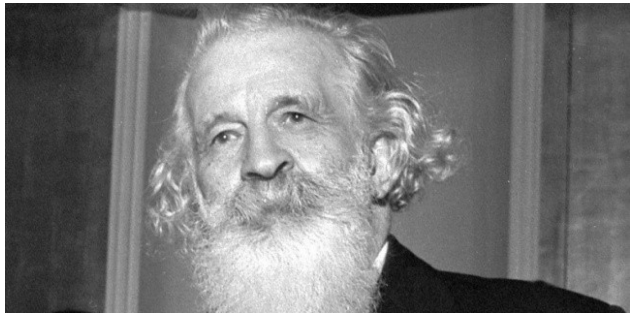
- Trainees often encounter difficulties to appropriate the level of radiation doses associated to an observed biological effect

The Didactic triangle



Learning process

- Jean PIAGET



the concept of « epistemological obstacle »

The content of knowledge is not neutral with regard to learning process

Pierre PASTRE

Human development at the work place

Say « I can » before saying « I know »

Learners are not as *tabula rasa* .

KNOWLEDGE

- History of radioactivity is build on series of accidents and disasters

KNOWLEDGE

At the beginning of the training

- Try to help learners to become aware of these existing representations in their mind, their preconceived ideas

- Use these preexisting elements to construct the different concepts of dose, determinist effects and stochastic effects

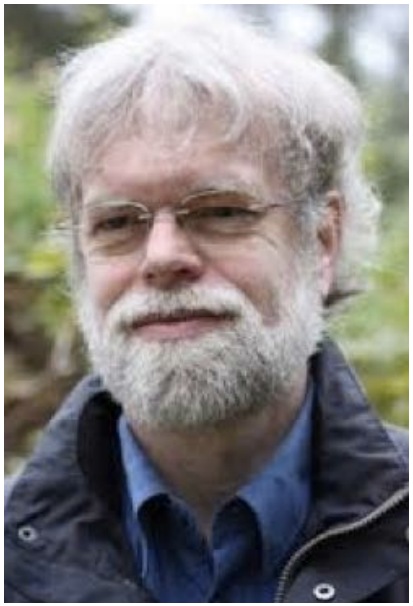
RISK: A POLYSEMIC WORD

- risk = an *unwanted event* which may or may not occur.
- risk = the *cause* of an unwanted event which may or may not occur.
- risk = the *probability* of an unwanted event which may or may not occur.
- risk = the statistical *expectation value* of unwanted events which may or may not occur.
- risk = the fact that a decision is made under conditions of *known probabilities* ("decision under risk")

RISK

- how to judge and assess the severity or the acceptability of risks?
- they are taken, run, or imposed

Sven Ove Hansson
Royal Institute of Technology, Stockholm



PERCEPTION OF RISK

Perception of risk is shaped by the features of the **percepting person**.

- LEVEL OF EXPERTISE
- PERSONAL CULTURE: history, values, belief, professional experience
- TARGET OF THE RISK : the person himself, somebody else…
- Is the person subjected to the risk or is he volunteer
- SOCIAL VARIABLE : level of the person in the hierarchical scale, implication in organisation, social environment
- SOCIAL RULES : behaviour of other neightboring people
- PERCEPTION OF OWN SKILLS AND DECISION-MAKING POWER

PERCEPTION OF RISK

Perception of risk is shaped by the **risk itself**

- Is the risk familiar
- Controllable
- Natural or technological hazard
- Occurrence of the risk (frequent or not)
- Immediate or delayed consequences
- Number of persons potentially concerned
- Mediatization

HEURISTIC

Heuristic refers to experience-based techniques for problem solving, learning, and discovery that give a solution which is not guaranteed to be optimal. Heuristic methods are used to speed up the process of finding a satisfactory solution via mental shortcuts to ease the cognitive load of making a decision

- **Heuristic of representativity** : similar situation already encountered
- **Heuristic of disponibility**: disponibility of information coming first to mind (media role)
- **Anchoring heuristic** : people allow more confidence to information confirming pre-existing beliefs

Expert approach simplier: severity and frequency

RISK

Make the risk acceptable for the learner

- Explain the figures
- Explain the statistical construction of the risks level
- Move the learner from the subjective field to the objective field

THE CONTROVERSY

- Low level doses exposure defined by
  - Metrology and the sensitivity of tools
  - Effet of the exposure (NOAEL – LOAEL) (Choice of the observed effect)
  - Difference with the public exposure level
  - ….

  For epidemiologist, low level dose is associated to low risk
- Treshold: no scientific consensus
- Individual sensitivity

Make the learners become aware of the scientific and societal controversy

THE TEACHER HAS TO

- Know exact and agreed data
- Use and explain exact and agreed data
- Explain the meaning of the figures
- Show that comparables risks have already been accepted in previous situations
- Show the positive aspects of the stake
- Guide the learner towards an active partner position

CONCLUSION

- Training is mandatory: It is the employer who must meet the legal requirement to have trained personnel at the workplace.
- Identify the difficulties encountered by learners
  - Psychological dimension of risk
  - Burden of the history of radioactivity
  - The controversy
- Give the learners time to help them to become aware of their preconceived ideas and conceptions
- Present the ethical values supporting the three pillars of radiation protection
  - **Trust in Radiation Protection policy is not a matter of opinion**

THANK YOU FOR ATTENTION