RC IV.

How to apply the systematic approach to radiation protection training?

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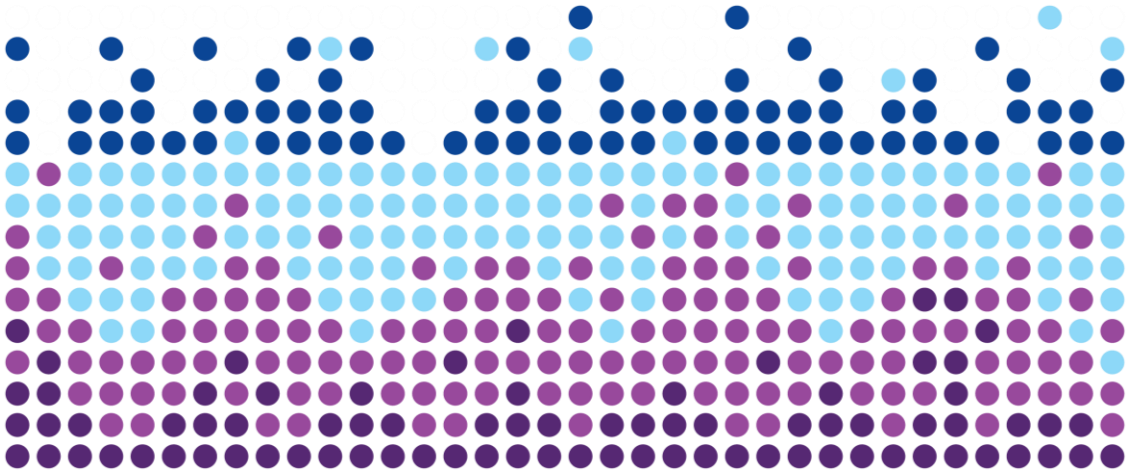
In this short refresher course, participants will learn about how to apply the systematic approach to radiation protection training. Via examples and cases, the logical steps of designing a training activity in radiation protection are discussed, starting from a needs analysis towards the development and implementation, including the multi-level evaluation. Working with learning outcomes forms an essential part of this process. Practical tips and tricks will be shared so that participants can apply the systematic approach to their own E&T activities in radiation protection.



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IRPA2022

Systematic approach to training

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Learning outcomes

Upon completion of this training module, participants should be able to:

- In terms of knowledge
  - Explain the process and steps of designing a training action
  - Identify the main points of the analysis of training needs
- In terms of skills
  - Analyze the need for training
  - Identify and write learning outcomes using Bloom's taxonomy
  - Define training strategy/pedagogical scenario the learning activities to be implemented in terms of time, means and resources (material/human), content, teaching methods, proceeding of activities; taking into account the possible constraints
- In terms of competences (autonomy & responsibility)
  - Conceptualize a training course according to the systematic approach to training

Analysis

- Analysis = Analysis of the needs
- Result:
  - Knowledge
  - Skills
  - Attitude

  } K+S+A = Competence

(EC approach)
- Knowledge
- Skills
- Competences (autonomy & responsibility)

- Critical component for
  - Starting a new training
  - Revising an existing training
  - Identify the gaps in one's competences

What is a learning outcome?

- **Statement** of what a learner **knows**, **understands** and should **able to do** on completion of a learning process, and which are defined in terms of **knowledge**, **skills** and **attitude**.
- Example

Upon completion of this training course, participants should be able to explain the mechanism of DNA damage to a non-specialist public.

How to write a learning outcome?

- In different domains (knowledge, skills and attitude), you can describe in one learning outcome

  1. Target public (= WHO)
  2. Element of the learning path after which learning outcomes aimed to be achieved (= WHEN)
  3. The action that must be made and the content to which it refers (= WHAT, cfr. performance)
  4. Situations, circumstances, the conditions in which this action must be made (= HOW, cfr. input)
  5. Expected performance level (= HOW ++, cfr. standards)

- Upon completion of this training course, participants should be able to explain the mechanism of DNA damage to a non-specialist public.

How to write a learning outcome?

- Best approach to start:
  - Upon completion of this training course, participants should be able to…

- Real learning outcome
  - = **action verb + specific content**

- Beware of good action verbs
  - Link to evaluation

How to write a learning outcome?

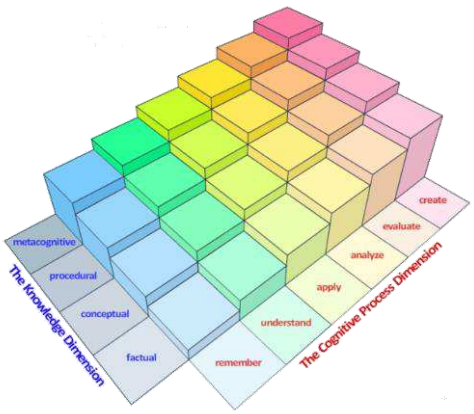
Action verbs

- Easy to assess
  - **Avoid** 'appreciate', 'become familiar with', 'comprehend', 'enjoy', 'know', 'learn', 'master', 'understand', 'compare and contrast', …
- Avoid the use of vague qualifiers
  - 'very', 'completely', 'fully', 'totally', 'quickly'…
- Good basis: Bloom taxonomy

Benjamin Bloom: Taxonomy of Educational objectives (1956)

Revision of Bloom's Taxonomy

- Cognitive process dimension
  - Remember
  - Understand
  - Apply
  - Analyze
  - Evaluate
  - Create
- Knowledge dimension
  - Factual (terms, elements,…)
  - Conceptual (conventions, criteria, classifications, stuctures,…)
  - Procedural (techniques, methods, algoritms,…)
  - Metacognitive (context, strategic, conditional,…)



- Anderson, L.W. (Ed.), Krathwohl, D.R. (Ed.), Airasian, P.W., Cruikshank, K.A., Mayer, R.E., Pintrich, P.R., Raths, J., & Wittrock, M.C. (2001). A taxonomy for learning, teaching, and assessing: A revision of Bloom's Taxonomy of Educational Objectives.

Write learning outcomes SMART

- **Specific:** Be as specific as you can (quantify if possible)
- **Measurable:** Measure during/after training
- **Attractive:** Connect with real life situations
- **Realistic:** Adapt to your audience, avoid jargon if needed
- **Time:** Adapt outcome to the size and attitude of your audience and the time given

References to learning outcomes in radiation protection

- ENETRAP Requirements for RPE Training Scheme and Reference Syllabus
- EC Radiation protection 174: MPE Guidance
- EC Radiation Protection 175: Guidelines on Radiation Protection Education and Training of Medical Professionals in the European Union
- IAEA Revised syllabus Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources, 2019

Analysis

- Output:
  - Needs
  - Target audience
  - Tasks and topics (meta)

- Pitfalls:
  - too broad (too much resources)
  - too narrow (training deficiencies and costly personnel errors)

"If you don't know where you are going, you'll end up someplace else"

Analysis **Design**

- Training approach is determined: efficiency and cost-effective

- Input from analysis phase
  - Information on knowledge, skills and attitudes
  - Content outlines

- Result:
  - **Learning outcomes** (SMART)
    - Some for classroom or online education
    - Some for practical training (exercise, OJT, simulations)
  - Sequence of content
  - Instructional and delivery strategy (Link to teaching styles)
  - Evaluation strategy

Analysis Design **Development**

- Produce the material required to implement the training programme
- Result:
  - Course material
  - Demonstration models
  - Didactic material for practical exercises
  - Training scenario's and storyboards
  - (technical framework for online content and feedback mechanisms)
- Do not forget:
  - Evaluation/assessment

Analysis Design Development **Implementation**

- Deliver the training programme in an **efficient** and **effective way**
- E.g.
  - Physical basis of radioactivity: classroom training or online
  - Personal protective equipment: hands-on demo and exercises

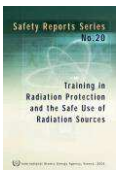
- Evaluate on different levels
- According to the Kirkpatrick Evaluation Model
  - Level 1: Reaction — ***Did they like it?***
  - Level 2: Learning — ***Did they learn it?***
  - Level 3: Behavior — ***Did they use it?***
  - Level 4: Results (impact) — ***Did it impact job performance?***

Dose/incidents

- Provide **feedback to other phases**

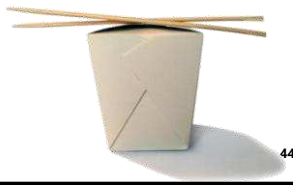
References to SAT, as applied in nuclear

- Systematic Approach to Training for Nuclear Facility Personnel Training: Processes, Methodology, Guidance and Practices. IAEA NES NG-T-2.8 (2019)
- Training in Radiation Protection and the Safe Use of Radiation Sources, IAEA SRS N° 20 (2001)
- Analysis phase of SAT, IAEA-TECDOC-1170 (2000)
- Experience in the use of SAT, IAEA-TECDOC-1057 (1998)
- Means of evaluating and improving the effectiveness of training, IAEA-TECDOC-1358 (2003)
- Department of Energy (DOE) Handbook, DOE-HDBK-1078-94 (2014), Training Program Handbook: A Systematic Approach to Training



Take away messages

- SAT offers for a structured approach in design, development, implementation and evaluation of training courses.
- Can be used for new courses, but also for existing ones
- Do not start to build your training course in MS Powerpoint
- Formulate SMART learning outcomes



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Analyse your audience needs: "What's in it for them?"

Analysis
Analyse functional competencies
Analyse level of competence

Design
Convert competencies into learning objectives as a design basis for the training plan

Development
Prepare training materials to meet learning objectives

Implementation
Conduct training on the basis of the course design and by using developed training materials

Evaluation
Evaluate on different levels to provide feedback and adjust the training

Systematic approach to training

Kirkpatrick Evaluation model

Level 1: REACTION "Did they like it?"
Level 2: LEARNING "Did they learn it?"
Level 3: BEHAVIOR "Did they use it?"
Level 4: RESULTS "Did it impact job performance?"

Knowledge + Skills + Attitude = Competence

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