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Operationalising European Competence

Frameworks in STEM Teacher Education:

A Training Kit Approach for the Green and

Digital Transition

Developed within the international Transforming Teacher Education for Green and Digital Transition Project

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European Competence Frameworks

STEM Teacher Education

Green & Digital Transition



Background and relevance

Sustainability, digital transformation and public health

Teacher education is currently facing three closely connected challenges:

- integrating environmental sustainability into educational practice;
- developing digital competences in a critical and responsible way;
- promoting scientific literacy on environmental risks (including radiation-related risks such as radon exposure).

📌 These challenges require competence-based educational approaches that combine scientific knowledge, critical thinking, communication and informed decision-making.

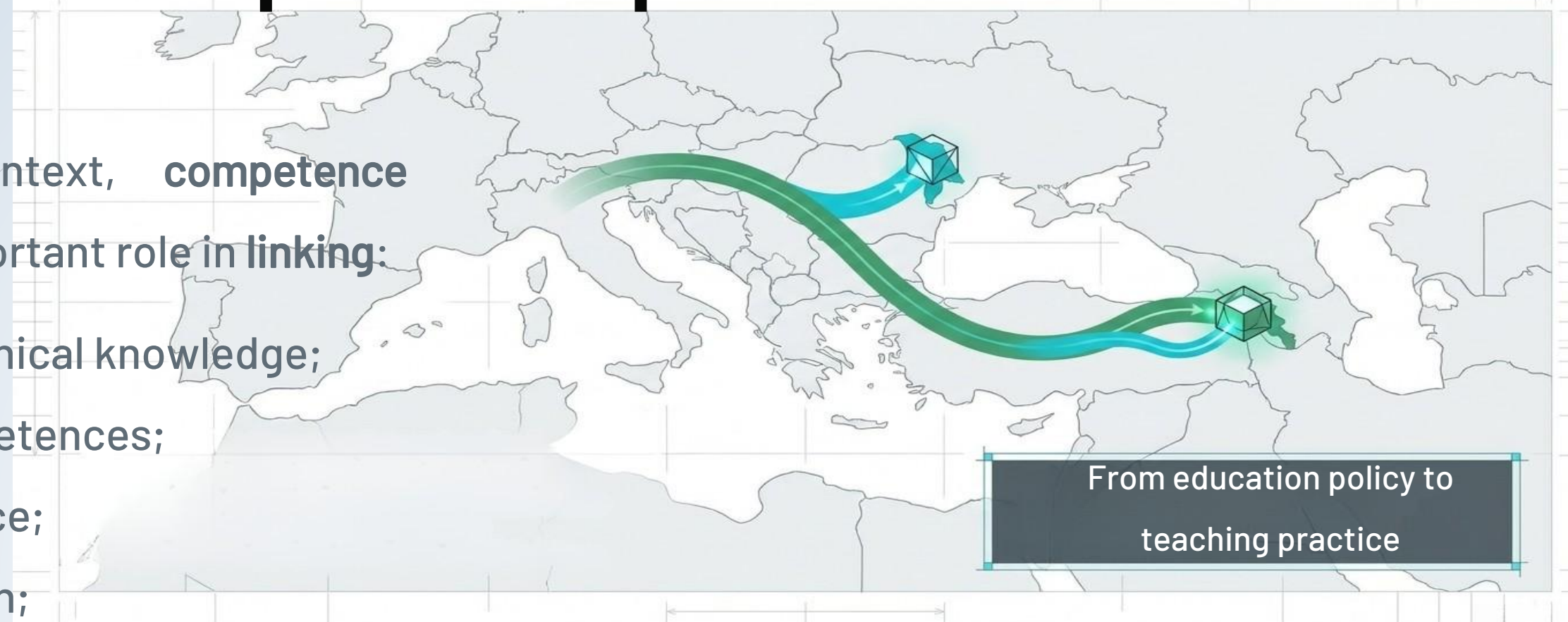


STEM education should prepare future teachers to work with real, complex and socially relevant problems, including environmental risks related to radiation.

European competence frameworks*

In the European context, **competence frameworks** play an important role in **linking**:

- scientific and technical knowledge;
- professional competences;
- responsible practice;
- risk communication;
- informed decision-making.



 In radiation-related fields, the frameworks supporting **Radiation Protection Experts (RPEs)** and **Radiation Protection Officers (RPOs)** are **relevant examples** of alignment between **specialised knowledge, professional responsibility and cross-cutting competences**.



Although these frameworks were developed for specific professional contexts, they can also inspire competence-based models in STEM teacher education.

* A structured reference document that defines the knowledge, skills, attitudes and responsibilities expected in a specific educational or professional context.

Identified problem

The central question of this work is simple but very important:

How can European frameworks be translated into concrete learning?

How can we move from policy documents and competence frameworks to teaching activities that are concrete, transferable and assessable?

This challenge is **particularly relevant** when aiming to integrate:

- sustainability;
- STEM education;
- environmental risk literacy;
- digital tools;
- inclusive practices;
- evidence-based scientific communication.



The challenge is not only to know the frameworks, but to transform them into meaningful and assessable learning experiences.

The T4Green project

Transforming Teacher Education for Green and Digital Transition

International cooperation

Armenia . Moldova . Portugal . Spain . Czech Republic

Its main aim is to support modernisation of teacher education through :

- STEM education
- Green transition
- Digital transition



This presentation focuses on Module 4

Structured pedagogical package composed of learning activities, guidance materials, case-study examples and assessment suggestions that can be adapted to different teacher education contexts.



The UBI contribution includes:

pedagogical and scientific design of the module, support for implementation and the evaluation of a transferable training model.

Module 4: structure of the training module

A model organised into four units

The module is structured into **four complementary** units:

1. Foundations of STEM education

Interdisciplinary integration, problem-solving and connection to societal challenges.

2. Active methodologies

Project-Based Learning, collaborative work and guided inquiry.

3. Design and assessment of STEM projects

Pedagogical planning, definition of learning outcomes and assessment strategies.

4. Digital tools and inclusive practices

Critical use of digital resources and promotion of accessible learning environments.

Partners and contribution:

- **Pedagogy in special education** (Masaryk University, CZ)
- **STEM education** (UBI, PT)
- **Foreign language** (Universidad de Valladolid, Spain).



The module was designed, implemented and evaluated as a progressive training pathway, supporting pre-service teachers from the conceptual understanding of STEM education to the design of concrete teaching projects.

Constructive alignment of the training module

Connecting competences, learning activities and assessment methods

Competence focus	Pilot learning activity	Assessment evidence
Scientific literacy	Analysis of radon-related information and environmental radioactivity concepts	Participants produced materials and reflective activities
Sustainability competence	Discussion of indoor air quality, buildings and public health	Feedback forms and group reflections
Digital and data competence	Interpretation of radon concentration data	Analysis of data-based STEM activities
Risk communication competence	Development of communication materials for different audiences	Evaluation of produced communication outputs
Decision-making competence	Proposal of prevention or mitigation strategies	Reflection on transferability to future teaching practice



The module was designed through constructive alignment: competences defined the learning activities, and the assessment focused on evidence of competence development.

Competence development through a radon case study

Using radon exposure to develop STEM, sustainability and risk communication competences

Radon exposure was used as a **case study** to support the development of:

- **Scientific literacy:** understanding radiation physics and environmental radioactivity;
- **Sustainability competence:** relating indoor air quality, buildings and public health;
- **Digital and data competence:** analysing radon concentration data and interpreting evidence;
- **Risk communication competence:** explaining radiation-related risks to different audiences;
- **Decision-making competence:** proposing prevention or mitigation strategies.



Radon exposure provides a **real-world context** for developing sustainability, digital and radiation-related competences through STEM learning.

Radon case study: learning pathway

From environmental problem identification to risk communication

Participants moved through four main stages:

Problem identification



Indoor radon as an environmental and public health issue

Data analysis



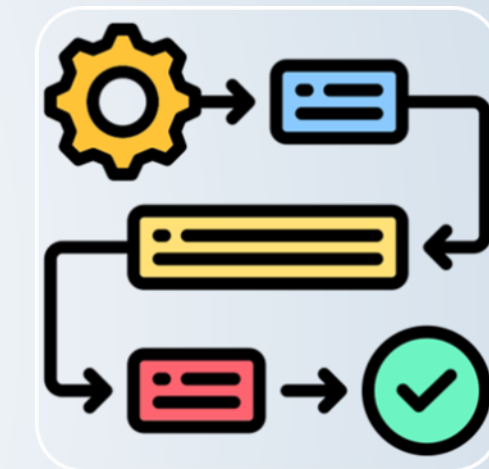
Interpretation of radon concentration data

Scientific reasoning



Discussion of physical, environmental and building-related factors

Risk communication and action



Communication materials for different audiences and mitigation strategies



The case study guided participants from scientific evidence to risk communication and informed action.

Assessment of competence development

The module was implemented and assessed during the pilot phase.

Evidence from the pilot implementation

The assessment focused on evidence of competence development through:

- feedback forms completed by participants;
- reflective activities during the training;
- analysis of produced STEM materials;
- qualitative evidence collected during the pilot.



Assessment methods were aligned with the competences and learning activities developed during the pilot.

Pilot evaluation: main findings

The pilot evaluation showed three main findings:

- Increased confidence in integrating sustainability, digital tools and radiation-related topics into STEM teaching.
- Recognition of transferability to future teaching practice.
- Positive satisfaction with the structure, relevance and pedagogical value of the training kit.



The pilot confirmed the relevance, feasibility and pedagogical value of the training module.

An example from the pilot

Mathematics students designed PBL activities using **mathematical models** to address **environmental and sustainability issues**.

Added value of the training module

From pilot implementation to transferable educational practice

Competence-based design

European frameworks translated into learning activities

Transferability

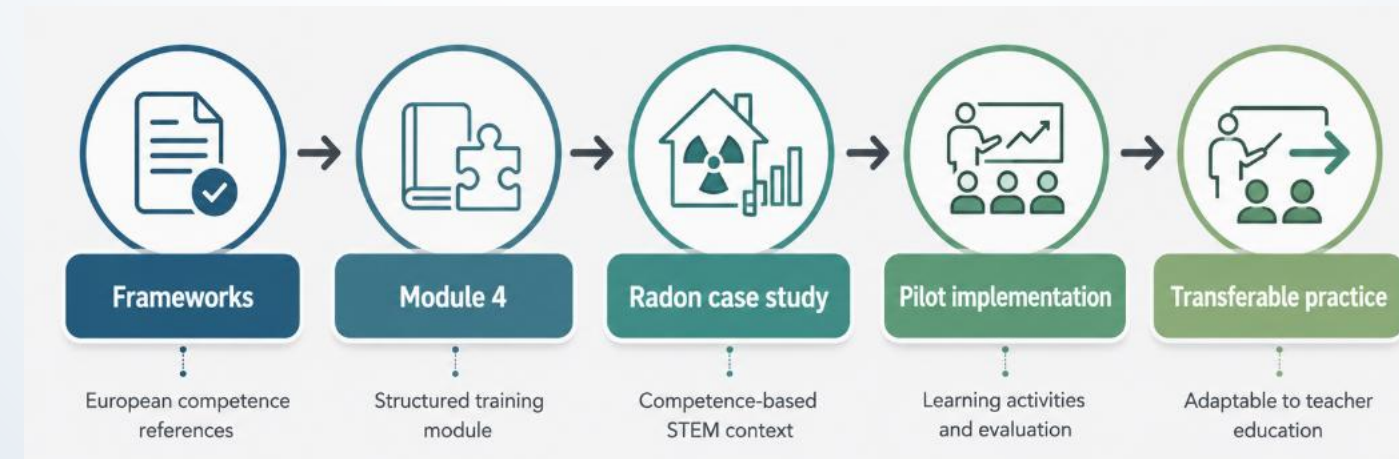
Adaptable to different teacher education contexts

Real-world STEM context

Radon exposure used as an environmental case study

Educational impact

Connecting sustainability, digital competence and radiation literacy



The training module connects European competence frameworks with transferable STEM teacher education practice.

Contribution to radiation protection education

Extending radiation protection competences to teacher education

Although this module is not designed to train Radiation Protection Experts or Radiation Protection Officers, it draws on the competence-based logic of these European professional frameworks.

By introducing radiation-related environmental topics, such as radon exposure, into STEM teacher education, the module contributes to:

- improving radiation awareness among future teachers;
- supporting communication about radiation-related risks;
- connecting radiation protection education with sustainability and public health;
- promoting informed and responsible attitudes towards environmental risk.



The pilot implementation suggests that this approach can broaden the educational impact of radiation protection by bringing its key principles into teacher education and, indirectly, into schools and society.

Teacher education as a lever for change

Translating sustainability, digital competence and radiation literacy into teaching practice

Future teachers need to be able to:

Design

STEM activities addressing sustainability and environmental risk

Use

digital tools for learning, data analysis and communication

Promote

critical thinking, inclusion and responsible citizenship



The green and digital transition becomes educationally meaningful when future teachers translate it into concrete STEM learning activities.

Conclusion

From European frameworks to educational practice

Pilot evidence

When: T4Green pilot phase, April - June 2026

Evaluation tools:

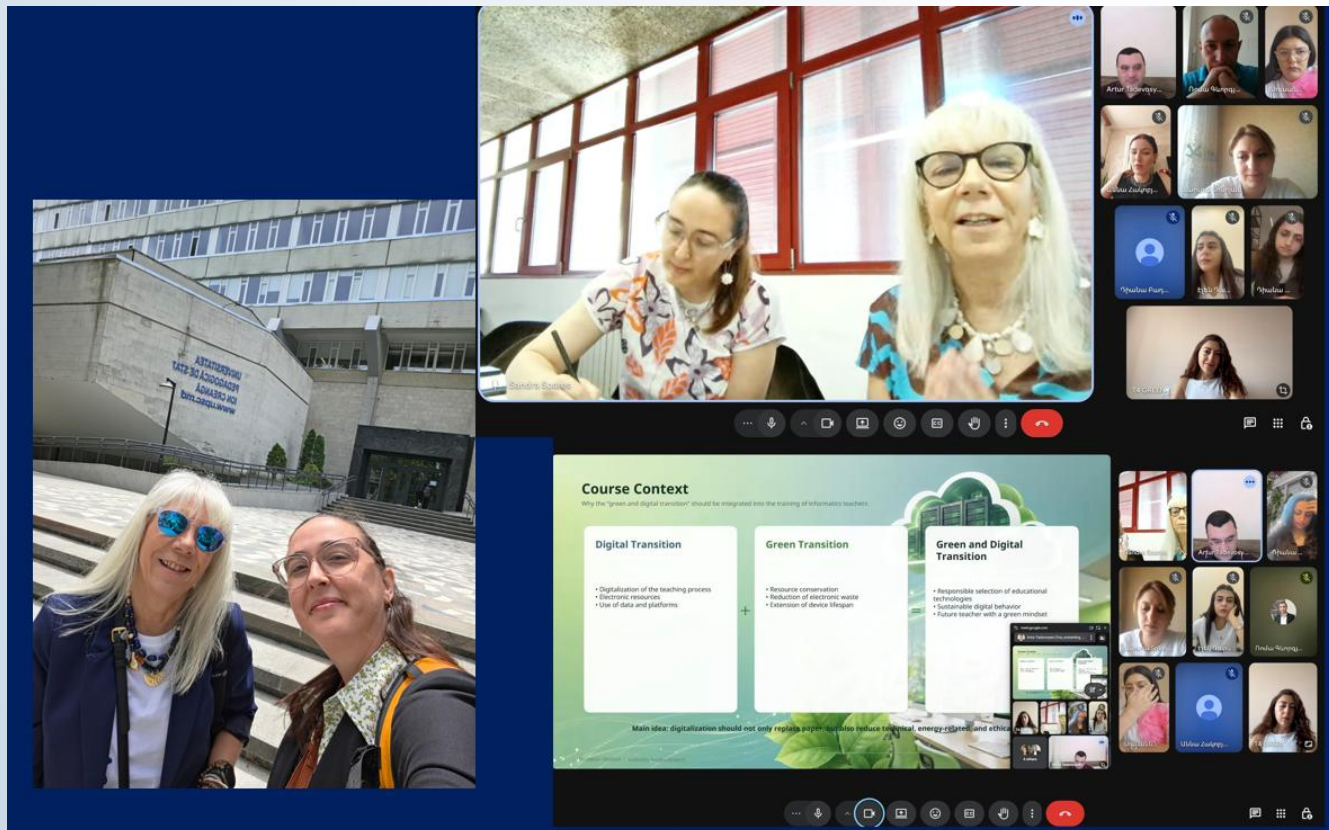
Feedback forms · reflective activities · analysis of produced STEM materials.

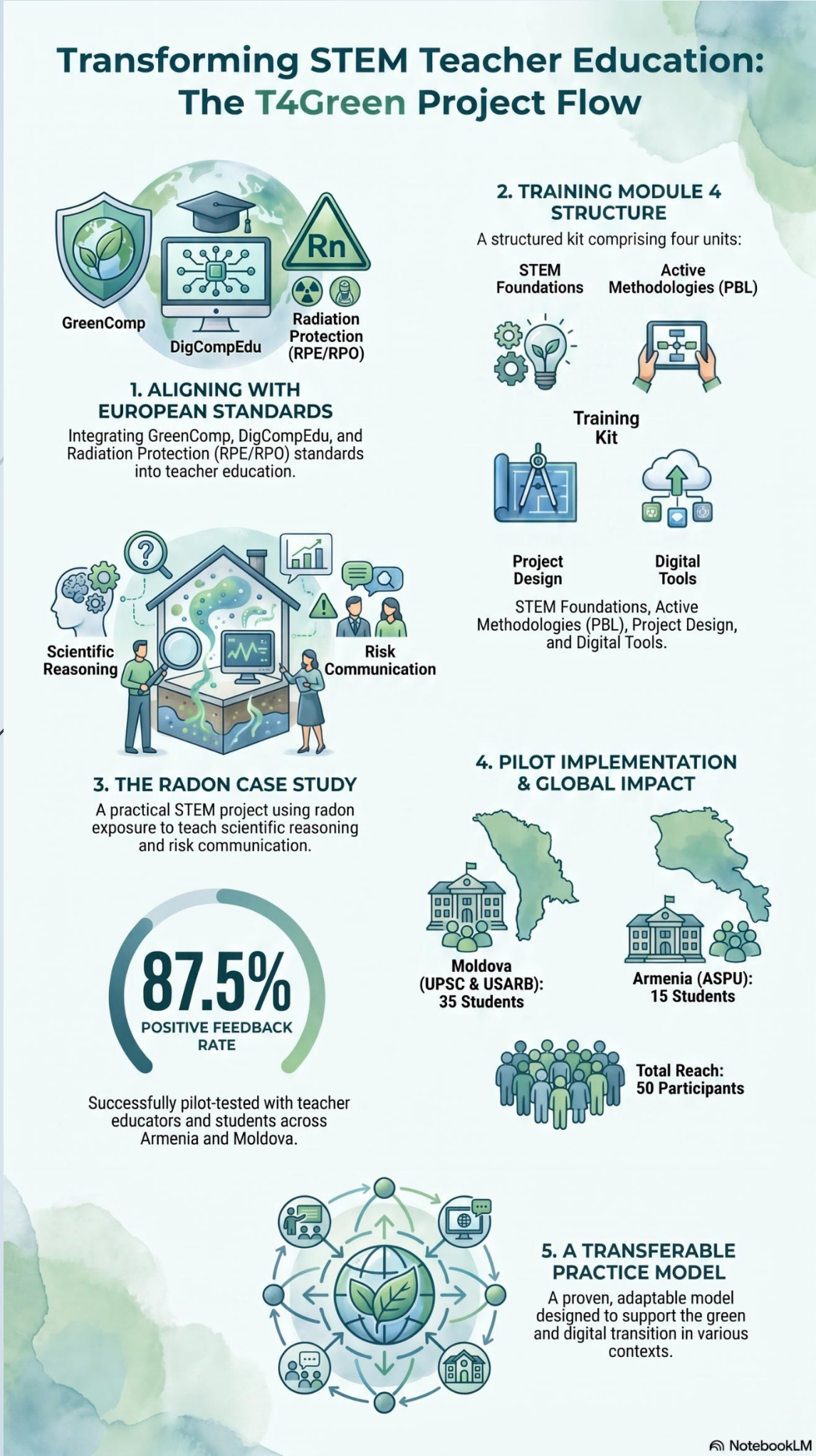
Participants (pre-service teachers/students involved in the pilot):

- 25 students from "ION CREANGĂ" State Pedagogical University of Chisinau (UPSC), Moldova
- 15 students from Khachatur Abovian Armenian State Pedagogical University (ASPU), Armenia
- 10 students from Alecu Russo State University of Bălți (USARB) in Bălți, Moldova

Main outcomes:

Positive engagement · competence development · transferability to future teaching practice.





Thank you for your Attention



The pilot provides evidence that European competence frameworks can be translated into concrete and transferable STEM learning experiences.

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