An Interactive Learning Unit about PET

Positron-Emission-Tomography

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Interactive learning units are a new, virtual, and versatile format for classroom and distance learning.
MOTIVATION

Enhancement of our online offers beyond the pandemic times

COVID-related challenges for our visitors to come to CERN

Extension of the hands-on PET workshop in our lab
AIM #1

Foster students’ interest in particle physics!

- **Past empirical studies:** Most students are interested in medical contexts
  OECD (2016), Levini et al. (2017)

- **My PhD project:** Conceptualisation of interest in Particle Physics
  Zöchling et al. (2022)

Even fewer students are additionally interested in contexts related to:
1. *science*, e.g., “elementary particles”
2. *technology*, e.g., “electronics”

Fewer students are additionally interested in everyday life contexts:
- specific examples, e.g., “digital camera”

Most students are only interested in contexts related to:
1. *one’s own body*, e.g., “detectors in medicine”
2. *socio-scientific issues*, e.g., “smuggled arms”
3. *existential questions of humankind*, e.g., “big bang theory”

This conceptualisation of interest in particle physics is valid for 79% of students
Even fewer students are additionally interested in contexts related to (1) science, e.g., “elementary particles” (2) technology, e.g., “electronics”

Fewer students are additionally interested in everyday life contexts: specific examples, e.g., “digital camera”

Most students are only interested in contexts related to (1) one’s own body, e.g., “detectors in medicine” (2) socio-scientific issues, e.g., “smuggled arms” (3) existential questions of humankind, e.g., “big bang theory”
AIM #2

Easy to use for teachers in classroom and distance learning

- **Duration:** 2 school lessons
- Can be done on one’s *own laptop or tablet*, in the *school IT room* or with *school tablets*
- **Target age:** 16+
AIM #2

Easy to use for teachers in classroom and distance learning

• **Format:** H5P Module
  
  ⇒ Can be easily **embedded in learning platforms** (e.g., Moodle, Blackboard, Brightspace, ...)

• **Link:** [cern.ch/petworkshop](https://cern.ch/petworkshop)
Examples for Anchoring in Curricula

**Austria**
- Secondary School
  - Grade 12
  - medical applications

**Germany**
- Secondary School
  - *in Baden-Württemberg*
  - Grades 9 and 10
  - medical applications

**USA**
- Next Generation Science Standards
  - *K-12 in 26 states*
  - Grades K-12
  - „The use of various applications of science, such as medicine, [...] would nicely facilitate student interest”
LANGUAGE

• English
• Subtitles in different languages
STRUCTURE
STRUCTURE

Explanatory Videos

\[ e^+ + e^- \rightarrow 2\gamma \]

Total momentum = 0

Momentum conservation
STRUCTURE

Interactive Elements

Quizzes

Shortcuts
Additional Information

Additional information - What is the Compton effect?

When a photon travels through matter, there are different possibilities how it can interact with electrically charged particles along its path.

If the photon has a relatively low energy, most likely it will be absorbed by an electron that is bound in an atom. By absorbing the energy of the photon, the electron might get enough energy to leave the atom. To free the electron from the atom, part of this absorbed energy is needed (equal to the binding energy between the electron and the atom). Then, the rest of the absorbed energy transforms into the kinetic energy of the freed electron. We call this the photoelectric effect. The total momentum...
STRUCTURE

Interactive PET Experiment

High Coincidence Count
STRUCTURE

Interviews with Experts

Your interview partner is Etienne Auffray Hillemanns. She is working at CERN, the European Laboratory for Particle Physics.

- What are you working on at CERN?
- Why does CERN conduct research relevant for PET?
- What kind of PET research is conducted at CERN?
- Could I see the image of a scintillating crystal?
- Does CERN cooperate with researchers from other fields such as medicine?
NEXT STEPS

❖ **Subtitles:**
  Adding further languages

❖ **Advertisement:**
  Spreading the Interactive Learning Unit about PET among educators worldwide

❖ **Physics Education Research:**
  Panagiota’s PhD project aims
  • to **evaluate** the Interactive Learning Unit about PET and
  • to **develop** further Interactive Learning Units
Interactive learning units are a new, virtual, and versatile format for classroom and distance learning.
Thank you very much for your attention!

Looking forward to your comments and questions!

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Back-up Slides
## Examples for Anchoring in Curricula

### Austria

**Secondary School**

**Grade 12**

Nuclear Physics:
- natural radioactivity,
- ionising radiation,
- medical applications

Particle Physics

### Germany

**Secondary School**

*in Baden-Württemberg*

**Grades 9 and 10**

Structure of matter:
- ionising radiation
- medical applications

### USA

**Next Generation Science Standards**

*K-12 in 26 states*

**Grades K-12**

“The use of various applications of science, such as medicine, [...] would nicely facilitate student interest”