Working Group – S’CoolLAB 2

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Study trip to CERN

“Learning science and technology in out-of-school settings is based on the idea that learners use personal experiences and interact with others to construct knowledge of the world. This is the main idea of the sociocultural view of intellectual development. Sociocultural mediation plays a critical role in personalizing the museum experience, as well as other out-of-school experiences, for visitors”

Falk & Dierking, 2000
Some Context:

S’Cool LAB days at CERN
Extremely high demand for places
Variable previous knowledge
Rationale

• Students (16-19 yr olds) come to CERN to visit the facilities and to have a hands-on experience on particle physics in S\textsuperscript{J}Cool LAB

• The available experiments are:
  • Cloud Chamber
  • Electron Tubes
  • X-Rays

• Particle Physics is often part of their curriculum, more or less in depth

• E-learning courses on Moodle can help teachers to prepare students for the visit to CERN
The challenge!

«It would have been even better if we had known in advance what the students were going to work on in S^JCool LAB.»

Teacher from Spain, January 2016

«I don’t want to know too much before I come here, or it’s not a surprise, and I don’t discover anything new, and it’s not fun.»

Student from Estonia, March 2016
Our Groupwork Aims

• Select the notions which are really **vital** to enjoy and **understand the experiments**, what students need to know to make the most of the **experience**

• Trigger students' **interest**

• Find some **on-line resources** (pictures, videos, animations, simulations, etc.) that might help

• Create an **e-learning course** that is virtually '**teacher-free**', providing insightful activities for about three hours
Cloud Chamber experiments

• Assembly (worksheet) as major part of the activity

• Wait and see & interpret the tracks
Cloud Chamber experiments

Worksheet and some tracks

Place your black metal plate onto the dry ice. Make sure you have already soaked the felt inside the plastic container! If your plate becomes cold, the water vapour in the air will condensate/freeze on it and form a white “snow layer” after a few minutes. Since you need a black surface for contrast reasons, you would have to clean the plate.

Use Isopropanol to fill the groove of your metal plate - if you have it. This will help sealing the box.

Place your plastic container upside down onto your metal plate. Fit the box so that the box walls fit the grooves in the metal plate. Now your chamber is ready to detect particles. It will only take a few minutes until everything has cooled down and a stable sensitive area has formed.

At first, you will only see a rain-like mist of alcohol. Place your torch lights in a way, that they illuminate the alcohol mist right above the metal plate – that is the sensitive area of the chamber.
Cloud Chamber experiments

What students should know before coming to CERN

- How tracks in the chamber originate and evolve
- Natural radioactivity
- The world of particles
Natural Radioactivity

Environmental Radiation

CERN is growing a giant flower!

In a black hole?

Nope, but it’s going faster than the speed of light!
Electron tube experiments

Required knowledge:
• Where are the electrons produced?
• How are the electrons accelerated?
• How are the electrons focused?
• How can we make the electrons visible?
The aims of the electron tube experiment are that pupils learn about:

• Dependence of the appearance of the created light spot from the acceleration voltage
• Deflection of the electron beam due to a permanent magnet
• Deflection of the electron beam due to an electromagnet
• Application to CERNs LHC
Electron tube experiment proposes that pupils have to make predictions and then the real experiment, comparing predictions with observations!

Example of worksheet: Prediction vs. observation
Introduction

The goal of this experiment is to learn more about the particle acceleration and the deflection of electrically particles in magnetic fields. Students might have seen the Magnet-Test-Facility during their morning visit or have heard about the LHC before. If not, they should still remember old TV screen in which an electron accelerator can be found – very similar to the equipment they are going to work with.
The X-Ray experiments

X-Ray machine

Copper cathode

Worksheet available

Suggested activities to predict and discuss observations/evidences
The X-Ray Experiments

• The worksheet

prediction vs. observation
The X-Ray Experiment

The activities:

Making X-Rays visible
X-raying different objects
Simulated human body
Different materials
Suitcases
Head of an Alien
The X-Ray experiments

What students should know before coming to CERN

• What X-rays are
• How they are produced (naturally and artificially)
• How they interact with materials
Moodle Preparation Course

X-Ray experiments

X-RAY Experiment Preparation

INTRODUCTION

X-rays are high energy electromagnetic wavelengths which are both natural and artificial. They have several properties and they interact with matter following strict known rules.

In order to discover these properties, take advantage of these Moodle pages and activities, which will provide you with insight for purposeful understanding before coming to CERN.

Did you know that...

In this section, you can know that How X-ray is used usaully around us.
Conclusions

• Creation of three e-learning courses using the Moodle platform

• Provision of targeted resources to students and teachers to make the visit at CERN a significant learning experience
Evaluation

Challenges:
• Language
• Culture
• Timing

Easy aspects:
• Agreement on aims
• Choice of resources
• Use of Moodle platform
THANK YOU VERY MUCH!

どうもありがとう
Muito obrigado!
Vielen Dank!
Mulțumesc mult!
Grazie di tutto!
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References
