Biodiversity Scenario

- **Domain:** Plant growth problem domain. Plants are a critical part of the biodiversity on earth as they recycle our exhaled carbon dioxide into oxygen and pull water from the earth releasing it into the air.

- **Problem:** Students learn about the anatomy of plants, but rarely get a clear understanding about the mechanism and parameters of these core processes

- **Goal:** Give learners the possibility to explore alternative learning environments that foster the development of their scientific concepts and skills.

Biodiversity Scenario

- Local Scenario
  - Public areas: e.g. science centres
  - Structured institutional environments: e.g. school classrooms, university courses
- Educational Activities :
  - specific aspects of bio-diversity
  - how to collect data
  - how to design scientific instruments using IT tools
  - how to interpret data
  - how these data can be used in connection to interactive simulations and modelling tools
- Collaboration within local communities and the COLDEX global community.
  - Collaboration between two science centres, one located in Sweden and the other in Chile

Xperiment Huset

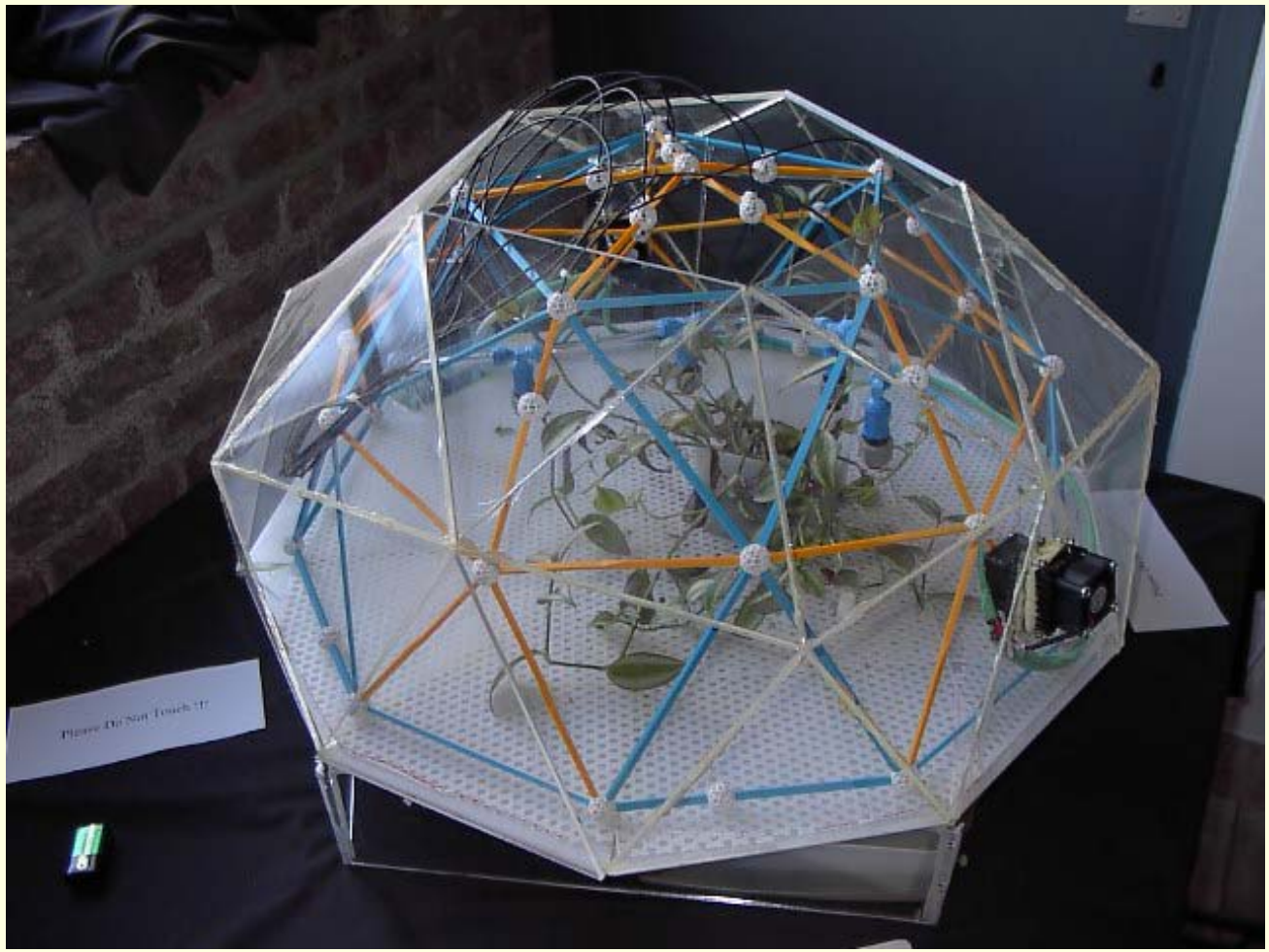
- Xperiment Huset Science Centre, Växjö, Sweden
- Space station exhibit that aims to give visitors a perspective about living, working and playing in space
- Challenges of an advanced Life Support System for colonization
  - Harvest in a far planet
  - Use of high-tech control and data collection systems

Scenario Resources

- Creation of a computer controlled plant growth chamber:
  - Hydroponics kits for plant growth
  - Sensors for relevant parameters: light, temperature, humidity...
  - Control of some parameters: CO_2 and light control mechanisms
  - Mobile devices used to process the data collection and analysis

- Terminals with web access to the COLDEX learning resources and simulation tools (connection to the COLDEX Learning Object Repository)

Scenario Resources



Scenario Activities

- Science centre activities
  - Simulation
  - Calibration and measurement
  - Real-time experimentation (Biosphere)
  - Building of low cost components

- Integrated Activities
  - Transition from the science centre to the school
  - Construction & Design
  - Modelling
  - Remote Data Collection

Simulation

- BioBLAST: simulation tool to experiment most issues related to space planting
- Challenge of finding an optimal set of parameters
- Work in pairs taking turns adapting the parameters and collaboratively analyzing the results of their simulated experiments
- Results can be annotated and stored in the COLDEX LOR for sharing with other users

Simulation

Skills and concepts developed:

Skills	Concepts
Scientific inquiry process	*Limiting Factors*
Parameter adjustment	*Balancing processes between respiration and photosynthesis*
Data analysis	*Scientific interpretation, hypothesis formation*

Simulation


Run # 1
Length of Experiment: 28 Days
CO2 Level (ppm):
10
600
2,000
300
1,200
10,000
Crew 1
Lettuce
BACKGROUND
SET
RUN
ANALYZE
CHALLENGE
DATABASE
JOURNAL
GLOSSARY
SAVE
RETURN
EXIT

BeLife Simulation Tool

- Under development at INESC-ID, Lisbon
- Simulation of a greenhouse
  - Plants and bacteria constitute the biological environment
- Based on real greenhouse activities
  - Plants' growth
  - Control the relevant parameters for plant evolution
  - Control bacteria epidemics

BeLife Simulation Tool

- Simulation using autonomous agent based technology
  - Every plant and bacteria is an autonomous agent
  - Agent Framework (WP3)
- Several views over the simulation
  - 3D interactive representation
  - Sound and tactile based representation for limited perception users (unsighted people)
- Connection to other COLDEX components: modelling tools, physical kits (this particular activity is consistent with our idea behind DEXTs, regarding the use of physical tool kits which are enhanced by computational objects)

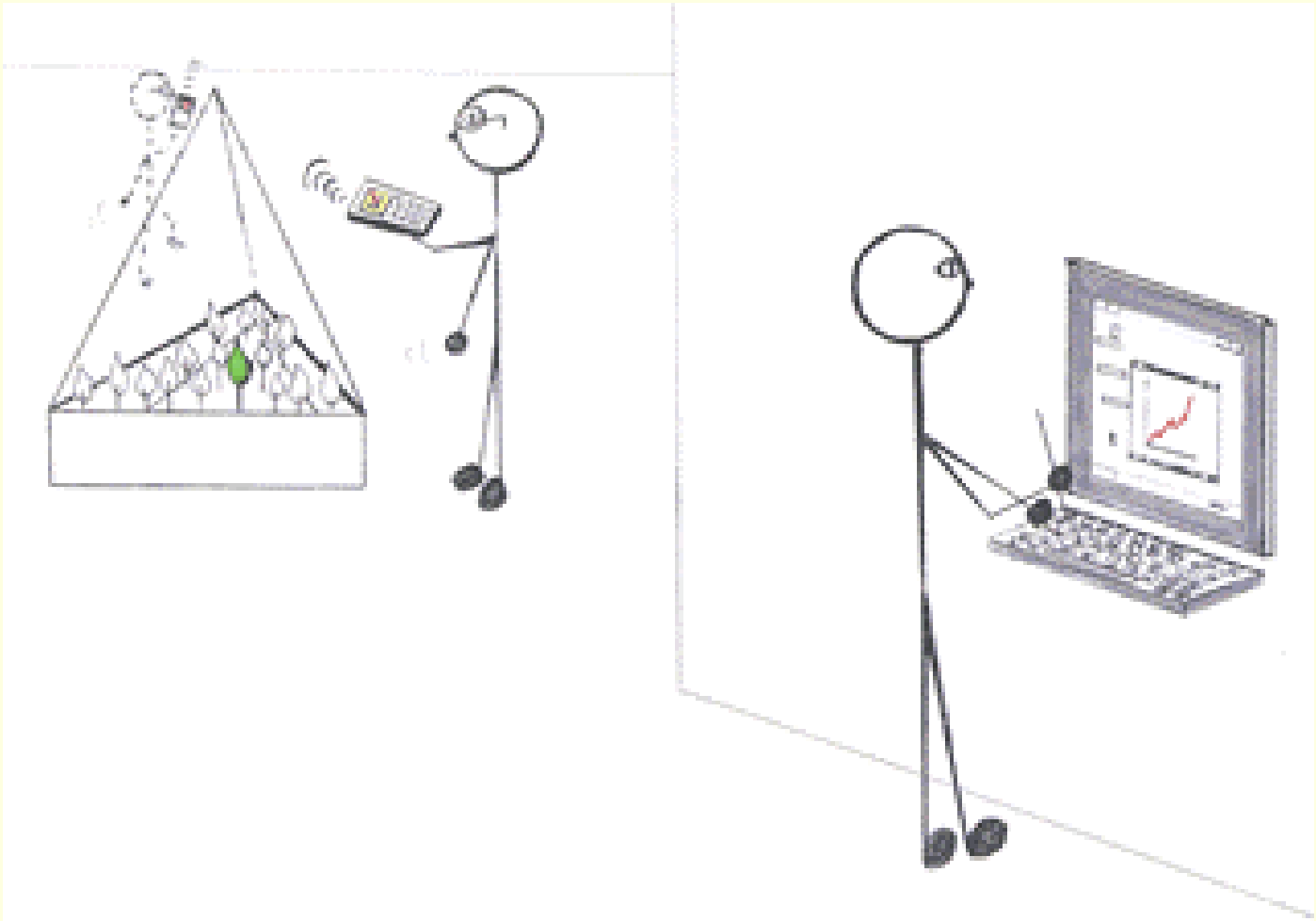
Calibration and measurement

- Collect data from sensors: thermometers, humidity, light, electric conductivity and CO_2 sensors
- Connect sensors to Lego Robolab programmable RCX and programmable calculators of type TI-83 systems
- Comparison with automated datasets
- Provides a conceptual transition between the virtual simulation and the real experimentation

Real-time experimentation

- Plan optimal harvest of lettuce, basil and tomatoes during a trip to Mars
- First challenge
  - Report optimal light conditions for basil growth
  - Problems that should be identified
    - What are the effects of increasing light on the photosynthesis rate?
    - Are other important factors also affected?
    - Why doesn't increasing the light always help?
    - What else is limiting the photosynthesis?
- Experiment in the computer controlled plant growth chamber
- Collaboratively annotate, predict and experiment – *cycle of conceptual refinement*
- Share the results in the COLDEX LOR

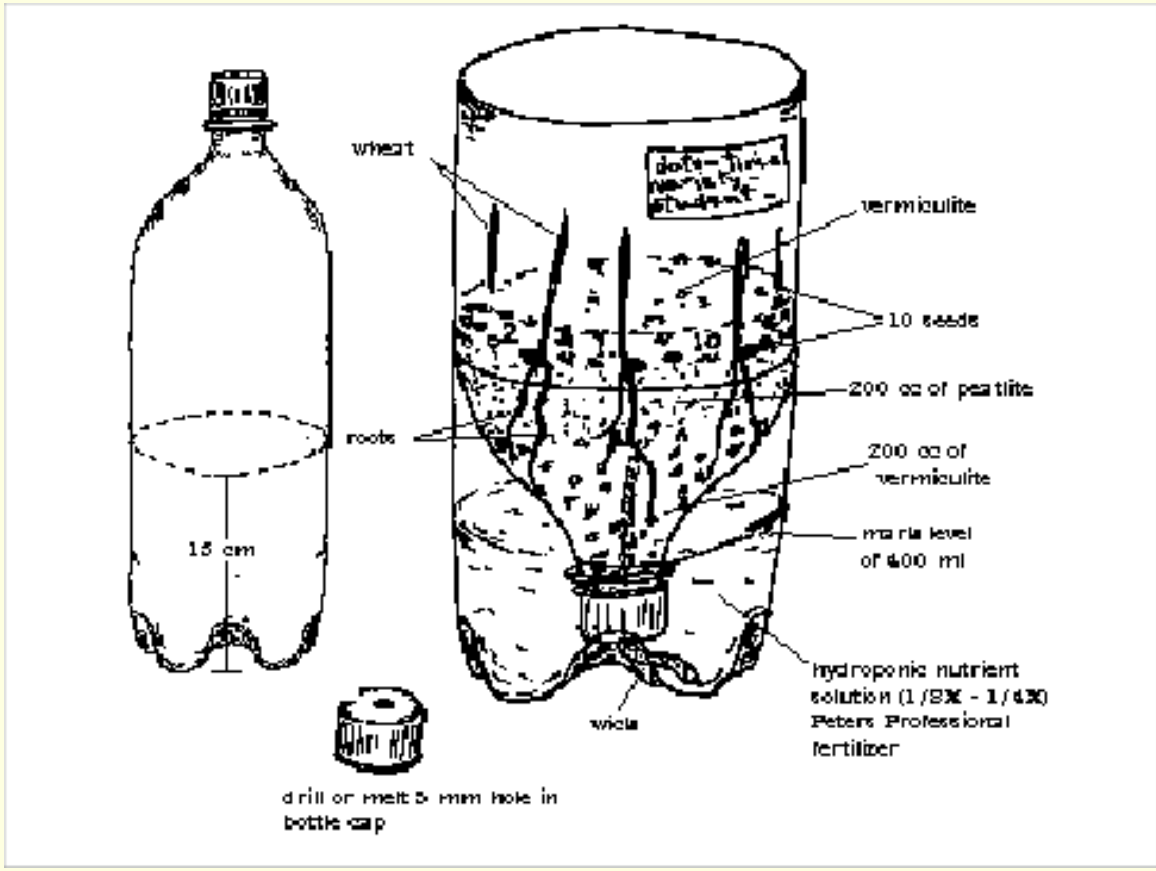
Real-time experimentation



Building low cost components

- Use recycled materials (e.g. plastic soda bottles) to create real hydroponics plant growth systems
- Connect high-tech sensors to the low cost kits
- Analyse the data collected in modelling tools (e.g. Cool Modes)
- Provide information and materials for students to recreate this activity in schools
- Share the results in the COLDEX LOR

Building low cost components



Integrated Activities

- Combination of educational activities to be conducted at different settings such as school/home and science centre.
- Prepare the activities before going to the science centre
  - Review the web-based materials provided at the COLDEX portal
  - Install and experiment with the simulation tools in the classroom and at home
- Continue the activities after the visit to the science centre
  - Be users at the science centre to become designers at the classroom
  - Analyse the data collected and stored in the COLDEX LOR
  - Use modelling tools and simulation tools
  - Remote data collection
  - Collaborate with other COLDEX communities

Integrated Activities