CIEL
Integrating approaches for Collaborative Inquiry and Experiential Learning
Collaborative Inquiry and Experiential Learning

Learning in which learners

- Work in a self-directed way
- Learn by investigating a given phenomenon or learn tasks in a simulated environment
- Build knowledge from data they gather
- Collaborate with others
- Are supported by cognitive tools
A CIEL scenario

European natural reserve agencies try to bring back salmon in European rivers. For this it is very important that the acidity of the water in the rivers is close to neutral (pH = 7). You are an inspector of the Dutch water quality agency and your task is to investigate (1) the water acidity in your assigned region, and (2) assess the risk of sudden changes in that acidity due to industry that is close to the rivers.
Example scenario

Field data

Chem lab

Modeling tool

Argument builder

Data Sets

Experiments

Hypothesis

Hypothesis

Argument
Learning processes

- collaboration
- modelling
- argumentation
- negotiation
- orientation
- hypothesis generation
- designing experimental procedure
- designing experiments
- synthesizing
- prediction
- data interpretation
- elaboration

Hypothesis generation

Hypothesis generation is the learning process of stating a hypothesis. Hypothesis generation takes a pivotal role in the process of scientific inquiry. A hypothesis can be generated as a theoretical idea on the domain or as a summary of data collected. In both cases it must be tested by doing experiments.
Tools and support

- coordination tool
- cognitive tool
- modelling tool
- pedagogical agent
- scaffolding
- fading
- guidance
- tutoring
- role taking

Pedagogical agent

Pedagogical agents are software agents designed to facilitate the learning process. Pedagogical agents play many different roles such as tutors (Johnson, et al. 2000), coaches (Constantino-Gonzalez & Suthers, 2001), critics (Fischer, et. al, 1991) and co-learners (Dillenbourg, et. al., 1997, coordinators (Wasson, 1998), or facilitators (Chen & Wasson, 2003). Pedagogical agents support both student and teacher decision-making by analysing what is going on in the learning environment and either reacting themself, visualising information that can be used to make a decision, or suggesting actions that can be taken by either a student or a teacher.
Emerging Learning Objects

General
- learning object
- repository
- resource
- simulation
- phenomenon
- model

Experimentation
- dataset
- experiment
- experimental design
- experimental procedure
- experimental setup
- experimental manipulation
- experimentation
- observation
- variable
- value
Dataset

A dataset is a collection of data collected from an experimental setup following an experimental procedure. The data is represented as a table in which each row contains a value for each of the variables in the dataset. A dataset can be collected as a time series, collected from a dynamic simulation or experiment, or be the result of a series of settings for input values.

On the dataset, aggregate variables may be defined as functions over the complete dataset, such as the sum or average value of a specific variable. Instead of being directly generated by an experimental setup a dataset can also be constructed, for instance by combining multiple datasets, or manually entering values.

A dataset may also be composed of multiple datasets sharing the same structure. For instance, one dataset may represent a sample of items. Aggregate variables may be the mean and standard deviation of the sample. A composite dataset may then be the collection of multiple samples. The rows in this new dataset are the aggregate variables in the composing dataset.

XML
dataset.xsd
The basic idea

Collaborative Tools

Inquiry Tools

Reporting tools

One environment

www.noe-kaleidoscope.org
CIEL’s contribution

- Theoretical work.
  - Learning processes
    - Inquiry, collaboration, ...
  - Learning objects
    - Datasets, experiment, model, ...

- Formalization
  - UML, XML
  - Metadata (LOM)

- Technical work
  - Repository
  - Connectivity for tools

Joint Theories
- CIEL Whitepaper
- CIEL glossary

Shared definitions
- CIEL glossary
- XSD definitions

Tool sharing
- CIEL broker
- Sample application
- CIEL Tools

www.noe-kaleidoscope.org
This demonstration

Adapted applications

Data generation

Shared repository of learning objects
Definitions
Metadata

Data processing

CIEL broker
The demonstration scenario

You are the assistant to a forest engineer and, as part of your job, you need to decide which forests are candidates for harvesting. For that, you have to take an inventory that gives the volume of wood in each forest. This volume is calculated using an estimation of mean diameter of trees. Your mission today is to design a sample strategy that leads to the best estimate and try it on a virtual forest.
Now it’s your turn

- **Design your own scenario!**
  - A few given ones
  - Or your own special one!

- **Think in terms of objects and tools.**
  - What is/are the inputs for the learners?
  - What tools do they use?
  - What do they produce?
  - How do these products serve as new inputs?
What is Next?

SCY

- Science Created by You
CIEL

- http://www.cielproject.eu