

SCY

Science Created by YOU

The SCY project
Learning by creating

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SCY basic principles

Science is all about creating knowledge:

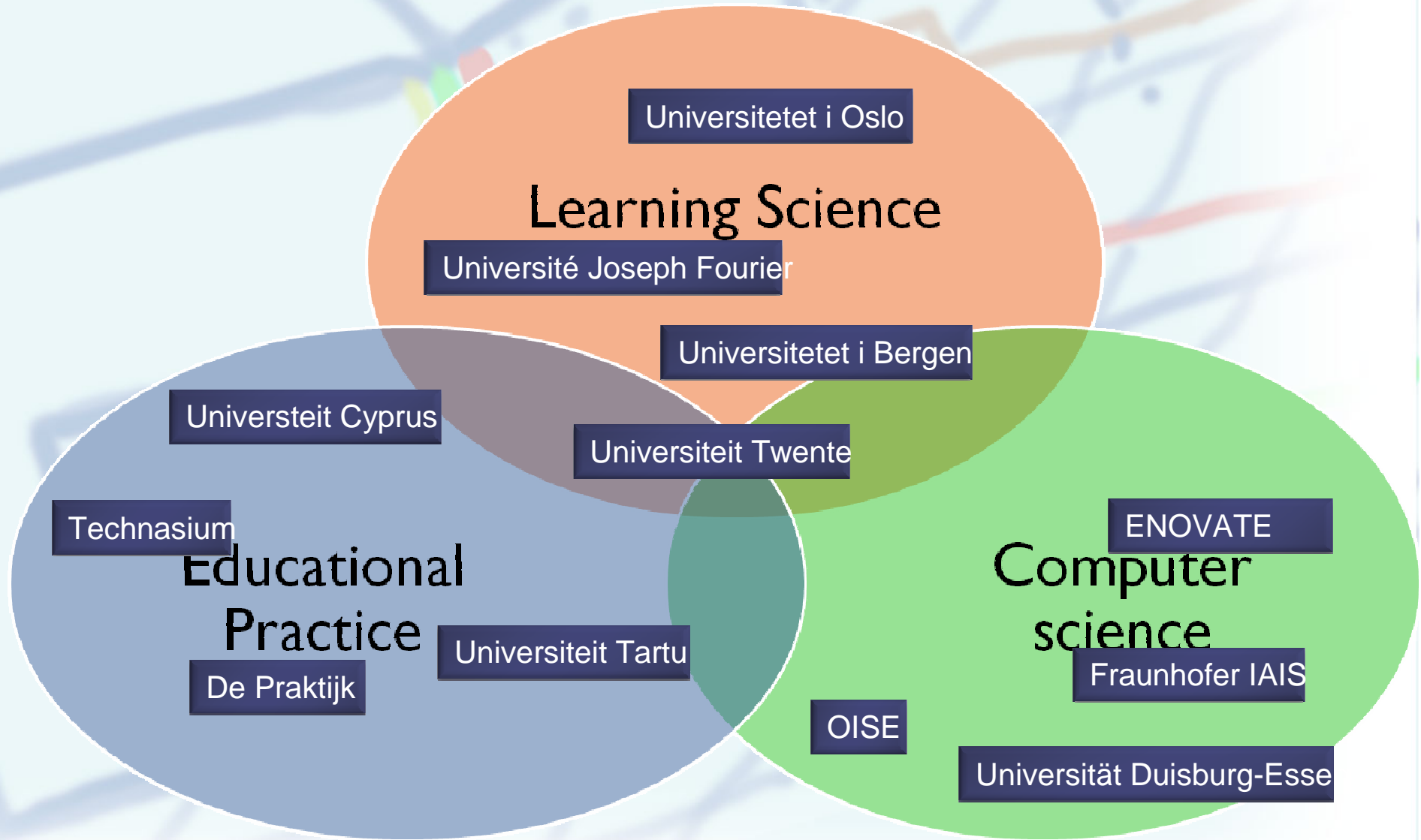
- ▶ Scientific theories
- ▶ Evidence to support those theories
- ▶ Material to convince others
- ▶ Data to inspire new ideas
- ▶ New ideas

Learning science is best done by doing science

- ▶ Design realistic scientific tasks that learners can handle
- ▶ Creating artefacts and knowledge is central
- ▶ Adaptively support the learner where needed



Who is SCY



Who is SCY



The project

- ▶ 12 partners
- ▶ € 8.000.000 budget
- ▶ € 6.000.000 subsidie

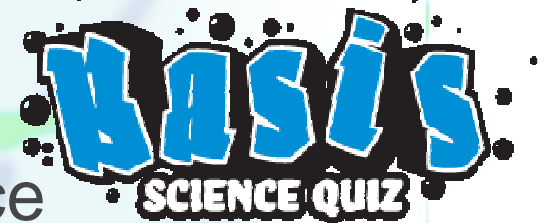
- ▶ Integrated Project
- ▶ Chosen first out of 255 applications

- ▶ Interdisciplinary project!
 - ▶ At least we try...



Strong relation to educational practice

- ▶ Teacher training institutes in Cyprus and Estonia
- ▶ Technasium
 - ▶ 27 schools in the Netherlands
 - ▶ Research and Design as topic for students
 - ▶ Strong relation with educational field.
- ▶ De Praktijk
 - ▶ Mission: increase public interest in Science
 - ▶ Free material for teachers and students
 - ▶ Open content



Educational Practice

- ▶ Technasium, De Praktijk and Teacher trainers ensure realistic image of schools and science education
 - ▶ Curricular integration
 - ▶ Realistic school scenarios
 - ▶ Approach the learner at the right level
 - ▶ And – often ignored – the role of the teacher
 - ▶ **The goal is not to replace but to support the teacher.**
- ▶ Realize an online teacher community
 - ▶ SCYCOM



SCY innovation

- ▶ New interpretation of “Learning Objects”

- ▶ Are made mainly by learners
- ▶ Represent growing knowledge
- ▶ Form the basis for a community of learners

Emerging Learning Objects

- ▶ Intelligent support by Pedagogical Agents

- ▶ Dynamic, ad-hoc collaboration
- ▶ Providing just in time information and scaffolding

- ▶ Advanced pedagogical scenarios

- ▶ Design, inquiry, ...
- ▶ Smart tools for knowledge construction

SCY for the learner

The screenshot displays the SCY-Lab mission CO2 House interface. It features several key components:

- SCY Simulation Panel (Green border):** Titled "SCY Simulation", it shows the "Architecture & Thermal characteristics of MyHouse". It includes a 3D house model, a table for "Choose wall materials" with columns for material, thickness, and U-factor, and a "Total" button.
- CO2 Data Panel (Red border):** Titled "CO2 Data", it displays a line graph of "CO2 concentration" over 11 days. The y-axis ranges from 0 to 7. The legend indicates three data series: T (Temperature), CO2, and H2O.
- Model of Greenhouse Panel (Blue border):** Titled "Model of Greenhouse", it shows a schematic diagram of a greenhouse with various components like solar radiation, heat loss, and internal heat sources.
- Background information Panel (Purple border):** Titled "Background information", it provides text and a small image related to the greenhouse effect.
- Chat Window (Yellow background):** A chat interface with a small video feed of a user. The conversation is as follows:
 - me: Hi Yuri
 - Yuri: Hi!
 - me: Did you model the heat?
 - Yuri: Yep
 - me: Did not work for me!
 - Yuri: Let's look together
- SCY Logo:** Located in the top right, it consists of the letters "SCY" in orange and green, with the tagline "Science Created by YOU" below it.
- Data Annotations:** Red arrows labeled "displays" and "supports" point from the "CO2 Data" panel to the "Model of Greenhouse" panel. Red arrows labeled "contradicts" point from the "Model of Greenhouse" panel to the "CO2 Data" panel. Red boxes labeled "D Temp Dat." are scattered around the interface.
- Word Cloud:** A cluster of colorful letters (G, U, P, E, M, D, S, E, M, C, P, G) is located at the bottom right of the interface.

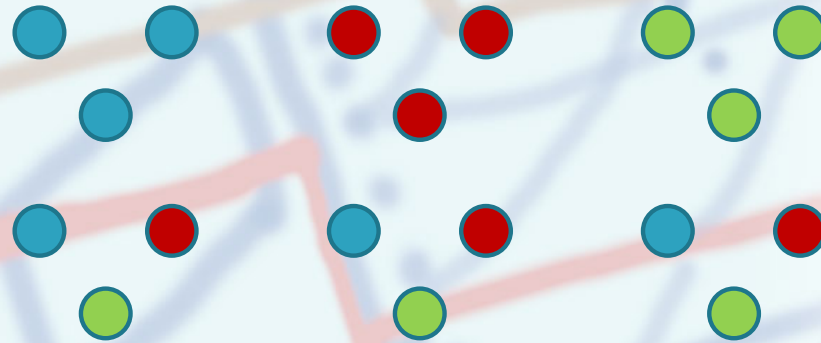
Missions

- ▶ Realistic project for learners.
- ▶ Typically 4-6 weeks, 20-40 lesson hours.
- ▶ Examples:
 - ▶ Investigate how cows can produce healthier milk
 - ▶ Design a bridge meeting technical and environmental requirements
 - ▶ Design a climate friendly house

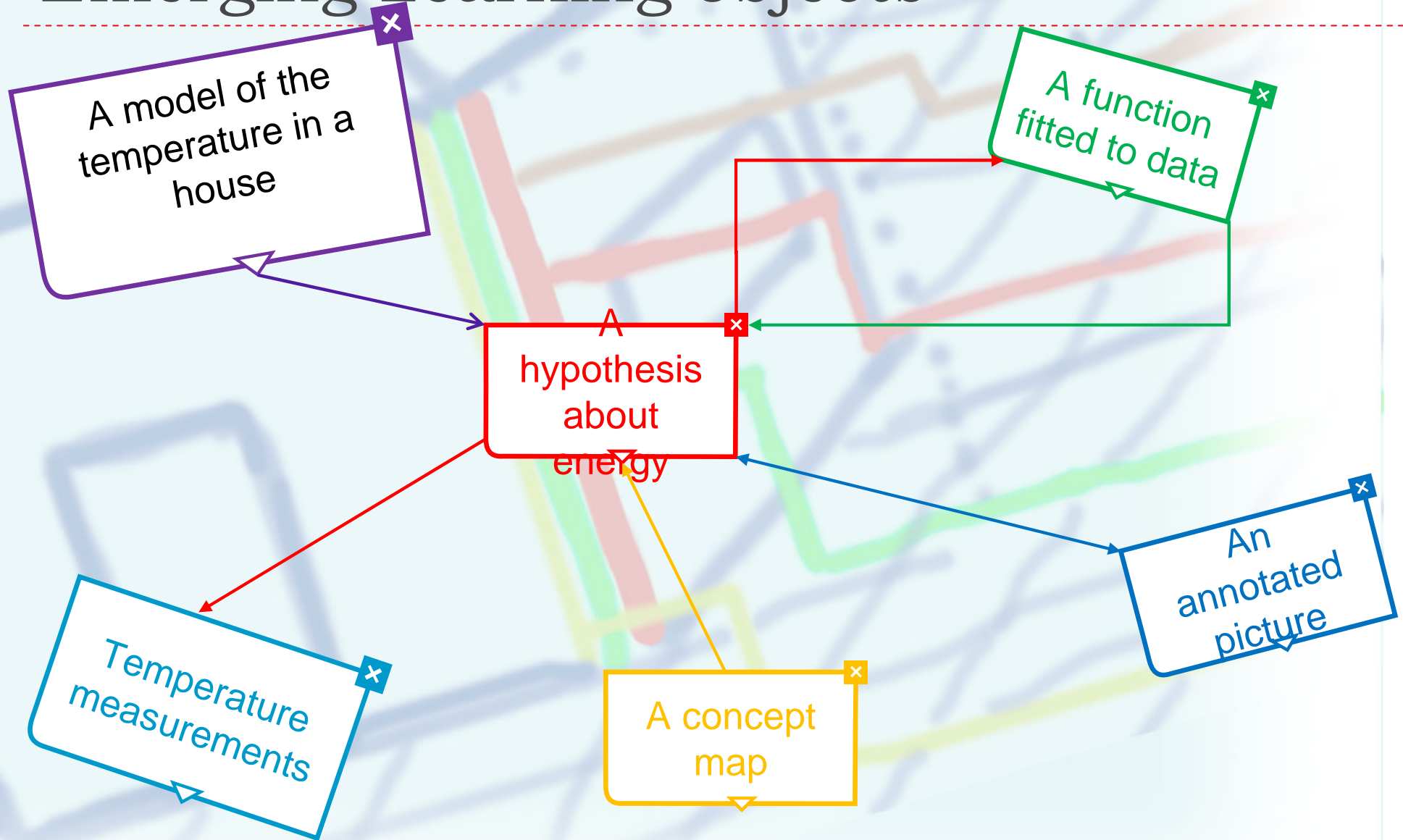


SCY Mission 1: Design a climate friendly house

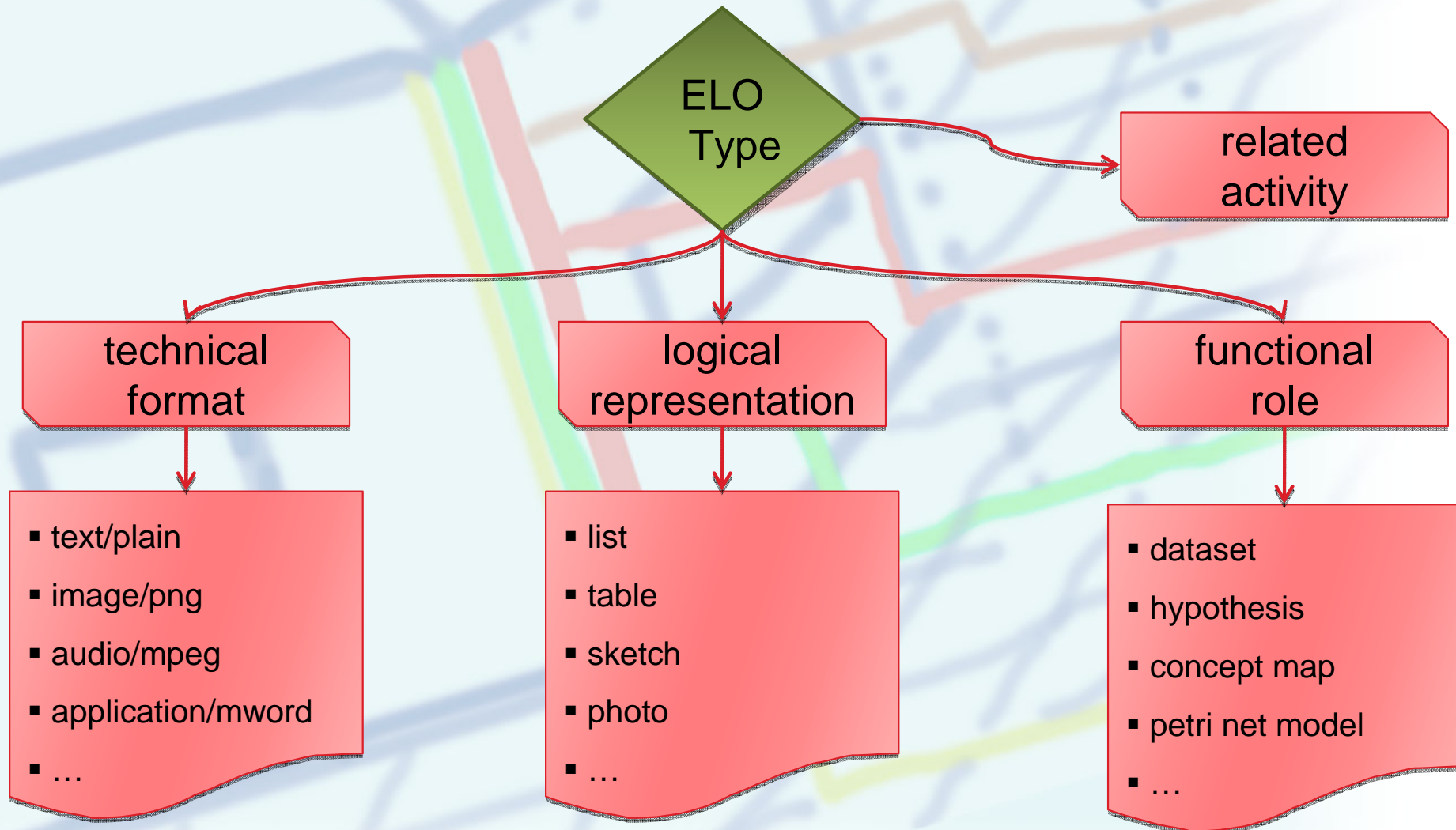
- ▶ **Dynamic groups:**
 - ▶ Expert group
 - ▶ Design group
- ▶ Simulations
- ▶ Field measurements
 - ▶ On their own house
- ▶ Design
- ▶ Competition
- ▶ Design-based scenario



Emerging Learning objects



ELO Typology and Ontology



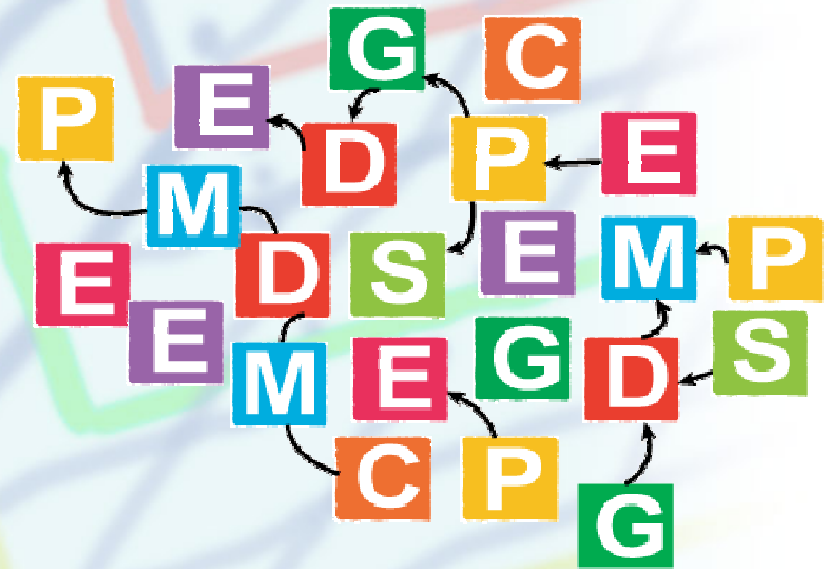
ELOS

ELOs ...

- ▶ form the starting point
- ▶ define intermediate steps
- ▶ and are the goal of the missions

Mission map

- ▶ Provides regulative support



Supporting learners in producing ELOs

The screenshot displays the SCY Lab (FX) interface. At the top left, there are four user avatars. A central window titled "SimConfig: review sim config" shows a physics simulation of a beam with two people sitting on it. The simulation includes force vectors: $F_{\text{reaction}} = -1000 \text{ N}$, $F_1 = 500 \text{ N}$, and $F_2 = 50 \text{ N}$. It also shows moments: $M_{\text{total}} = 550 \text{ Nm}$. Distances are marked as $a_1 = -0,40 \text{ m}$ and $a_2 = 1,50 \text{ m}$. Masses are $M_1 = -200,00$ and $M_2 = 750,00 \text{ N/m}$. A "Properties" window on the left shows "mass" and "force" buttons. A "Dataset: review data" window is also visible. In the top right, a user profile box shows: "Your Name: Wouter", "Your State: Online", "Current Mission: Another Mission", and "Progress: 74.5%". A "New" button is also present. A blue box at the bottom left is empty.

Services for communication, awareness etc...

Tools to produce and edit ELOS

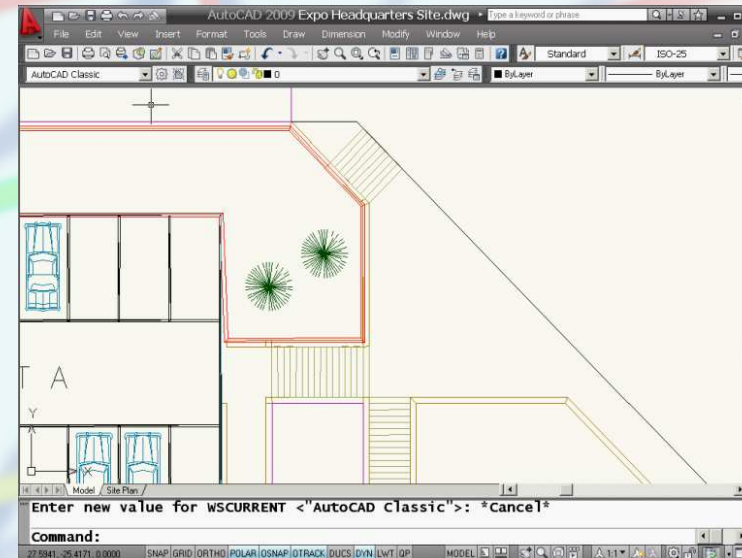
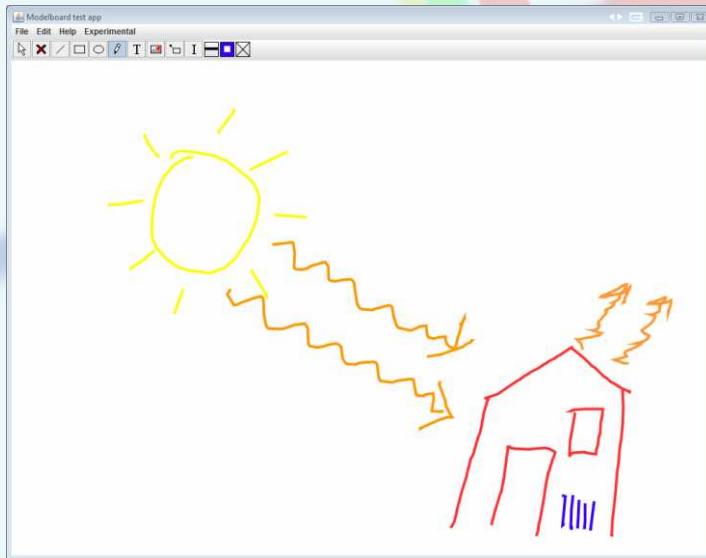
Scaffolds are integrated in tools and SCY-Lab

R C B M S



SCY Tools to create ELOs

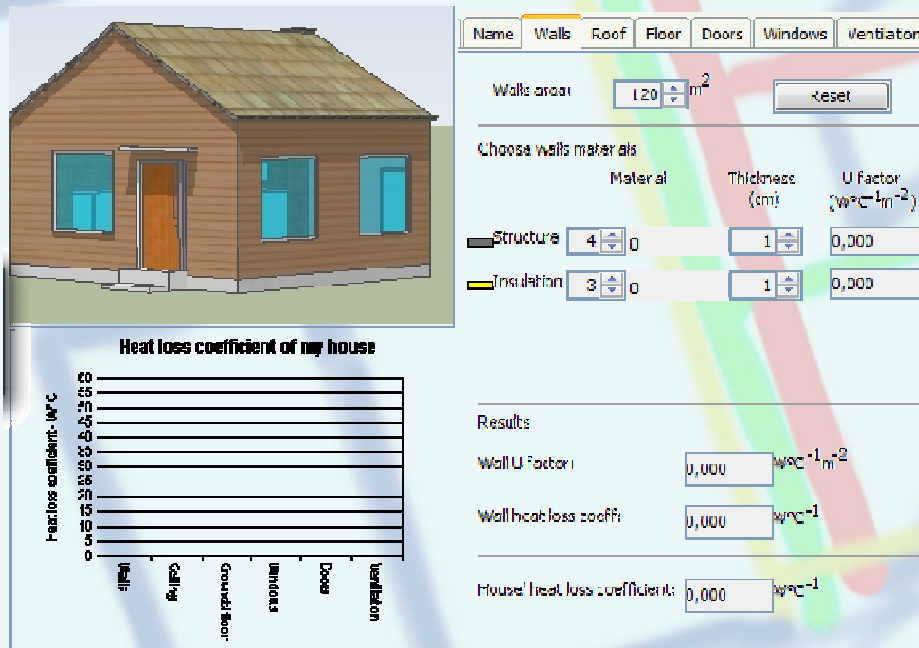
- ▶ Specialized cognitive tools
 - ▶ Drawing-based modeling
 - ▶ Visualization tools



- ▶ “Tools of the trade”
 - ▶ Tools that are used in real practice

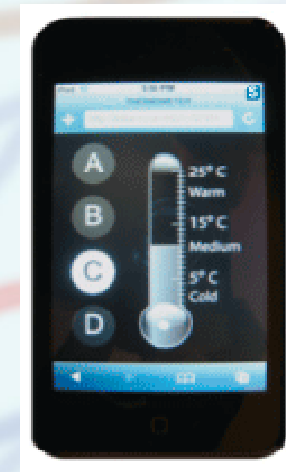
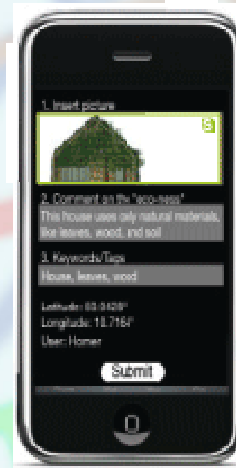
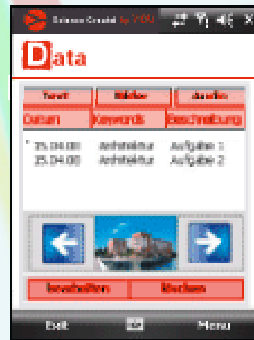
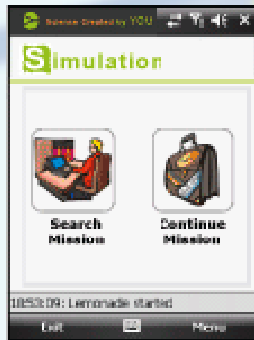


Simulations to gather data

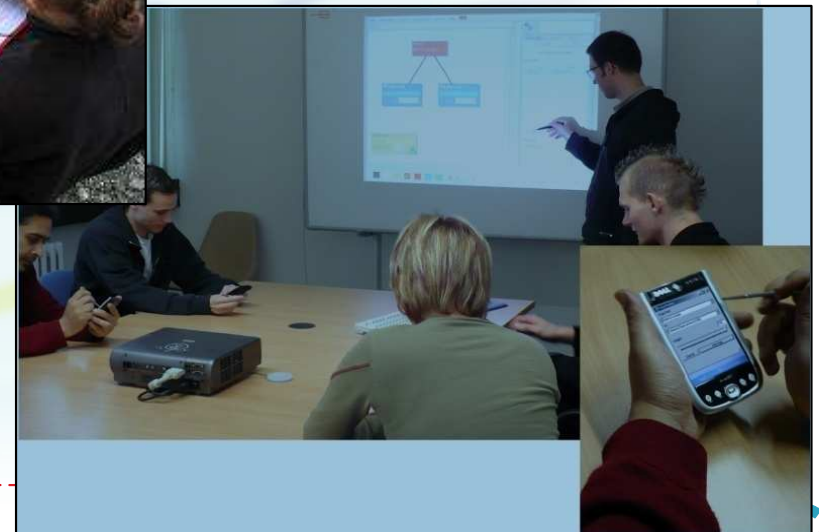


- ▶ Producing “Dataset” ELOs
- ▶ Specifically designed for learning purposes
- ▶ ELOs can be taken up in other tools
 - ▶ Data processing
 - ▶ Data visualization
 - ▶ Modeling

Mobile tools



- ▶ **Field work**
 - ▶ Measuring
 - ▶ Geolocation
 - ▶ Pictures
- ▶ **Group discussion**
 - ▶ Moderation
 - ▶ Individual contributions



The SCY approach to Tools

- ▶ **SCY-*fi*** – standards for tools
 - ▶ Conceptual
 - ▶ Technical
- ▶ **Tool broker interface**
 - ▶ Client side uniform access to server components
 - ▶ Will be a smart component (caching, load balancing etc.)



SCY-*fi*

Conceptual

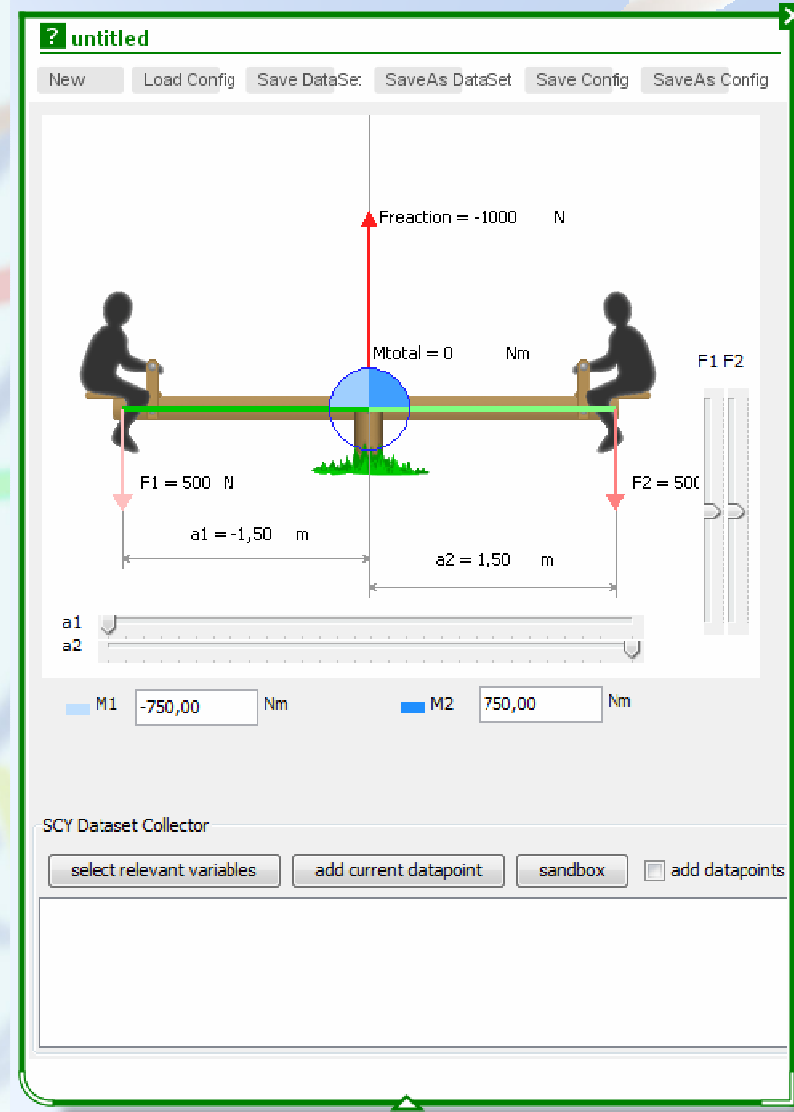
- ▶ Levels of integration
 - ▶ 3rd party tool
 - ▶ Standalone SCY tool
 - ▶ Mobile tool
 - ▶ Integrated tool (or service)
- ▶ User interface guidelines
 - ▶ SCY Style book
- ▶ Create an integrated
- ▶ SCY experience

Technical

- ▶ Storing and retrieving ELOs
- ▶ Remote control interface
- ▶ Collaboration and synchronization
- ▶ Tool-Broker Interface

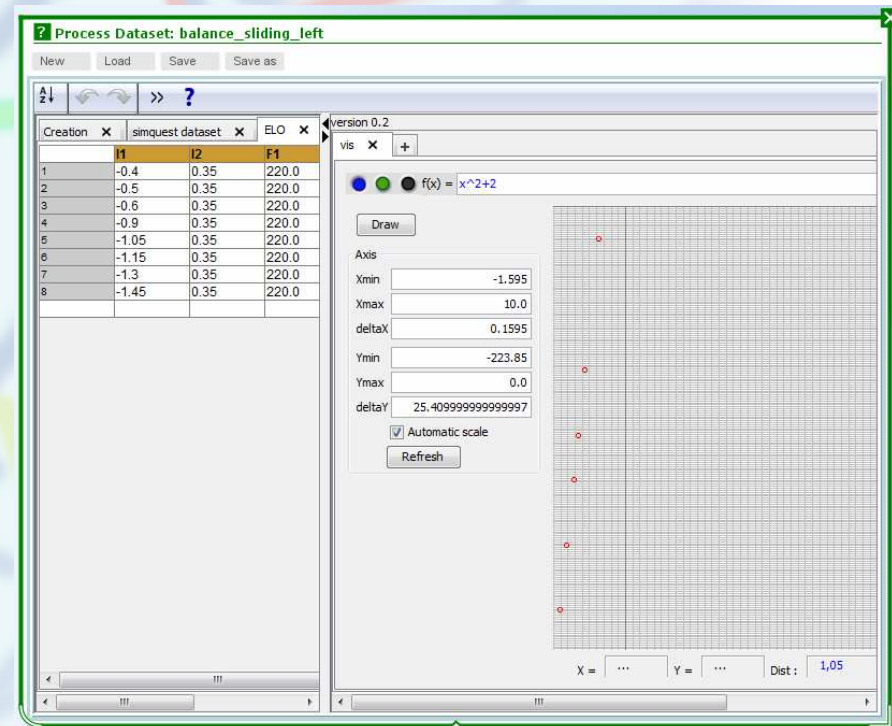
Tools and services

▶ Simulator



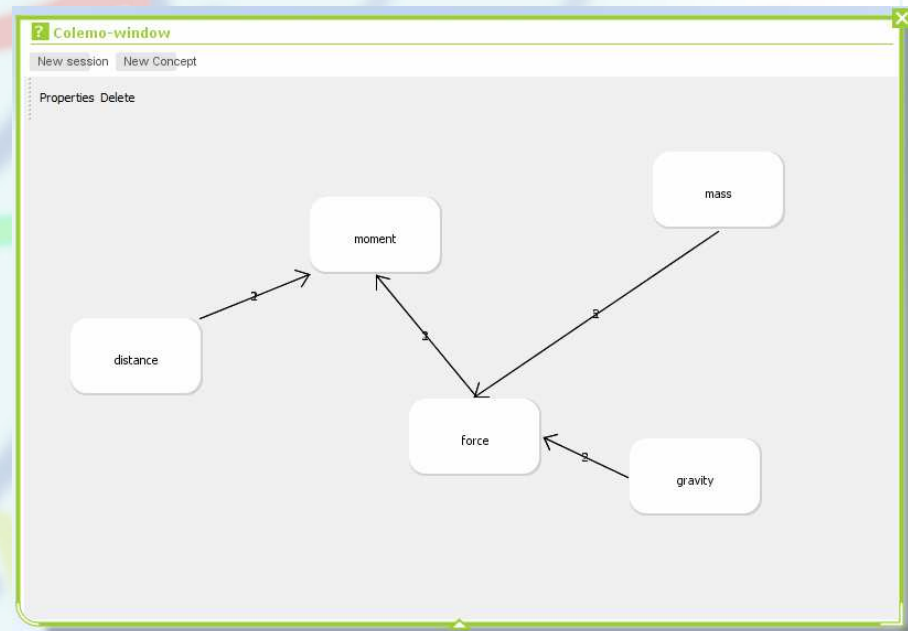
Tools and services

- ▶ Simulator
- ▶ Data processing and viewing



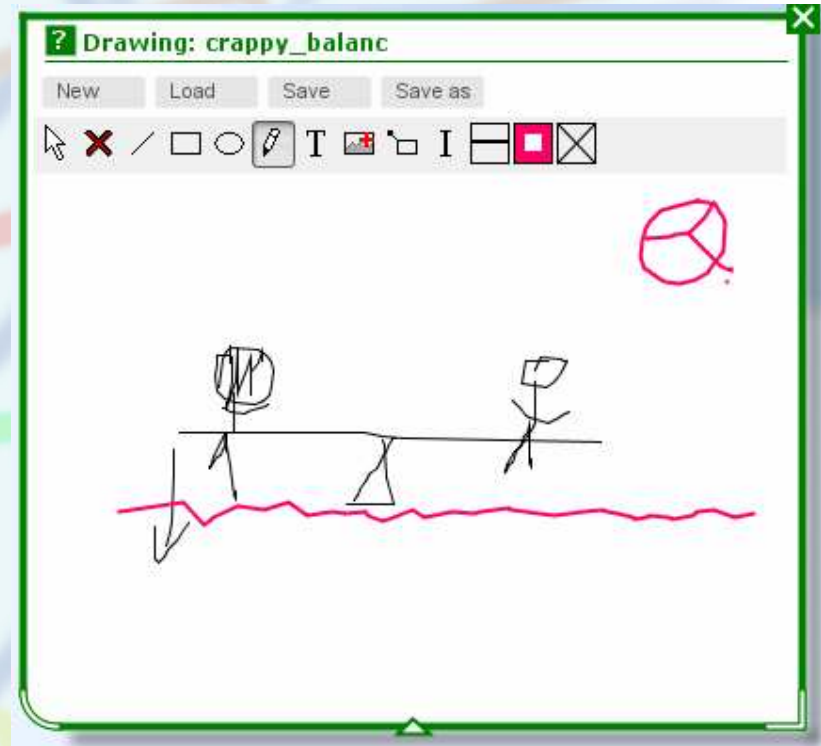
Tools and services

- ▶ Simulator
- ▶ Data processing and viewing
- ▶ Concept mapping



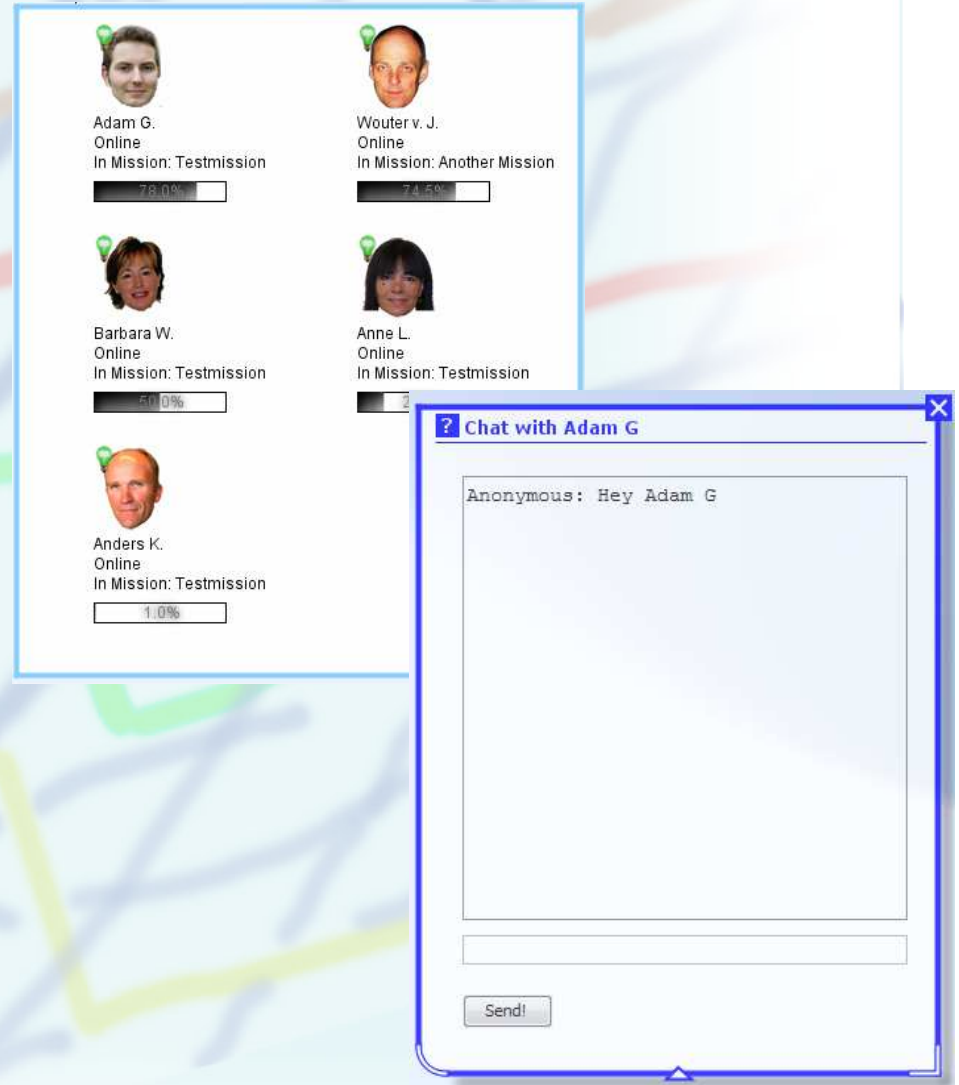
Tools and services

- ▶ Simulator
- ▶ Data processing and viewing
- ▶ Concept mapping
- ▶ Drawing



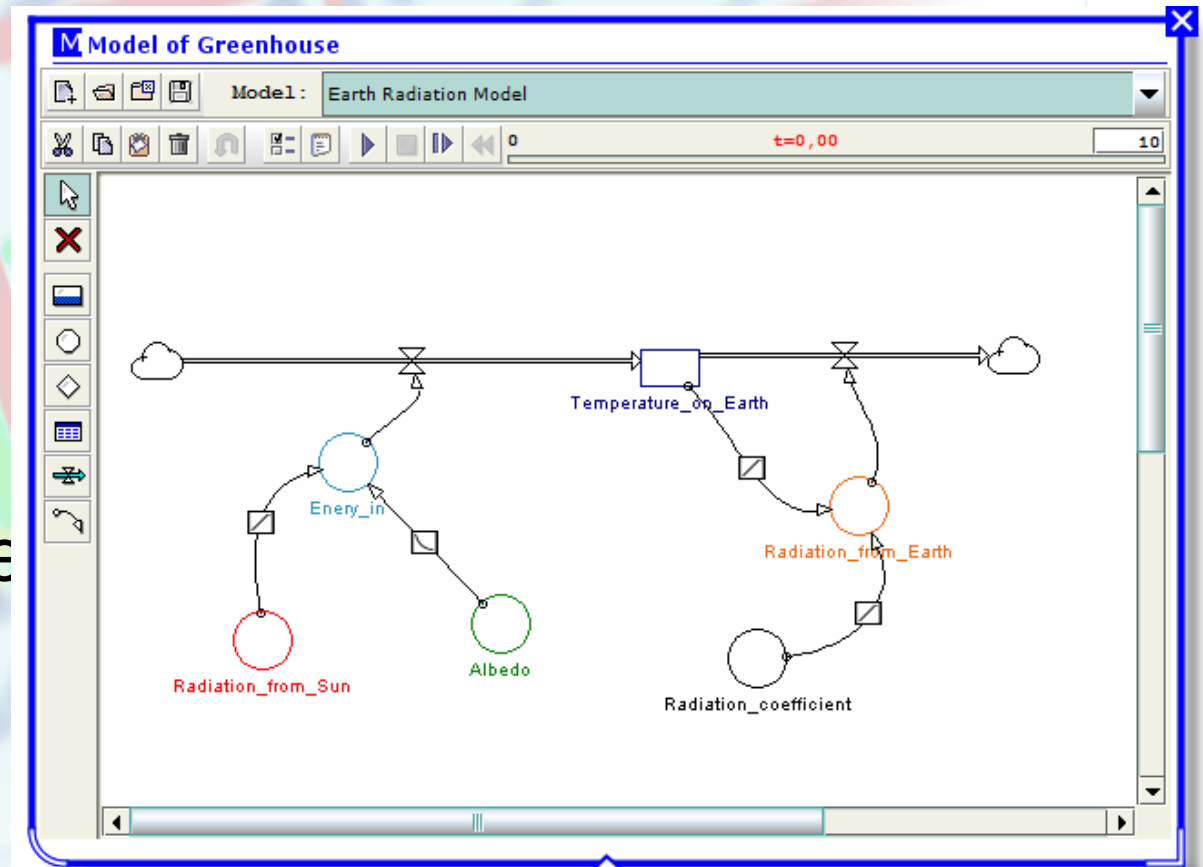
Tools and services

- ▶ Simulator
- ▶ Data processing and viewing
- ▶ Concept mapping
- ▶ Drawing
- ▶ Awareness and communication services



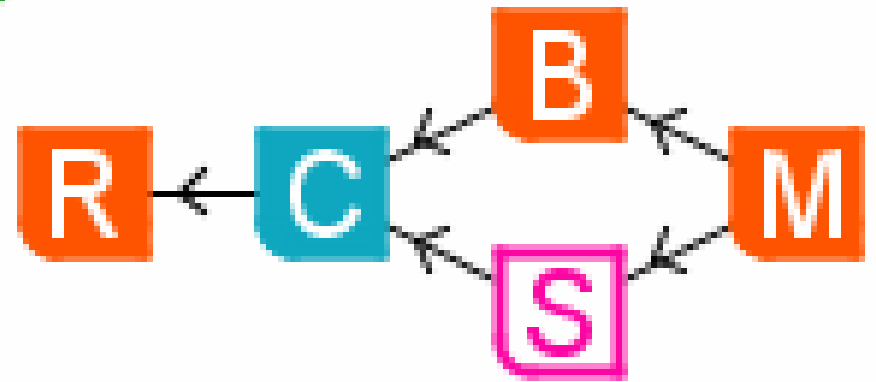
Tools and services

- ▶ Simulator
- ▶ Data processing and viewing
- ▶ Concept mapping
- ▶ Drawing
- ▶ Awareness and communication service
- ▶ Modeling tool



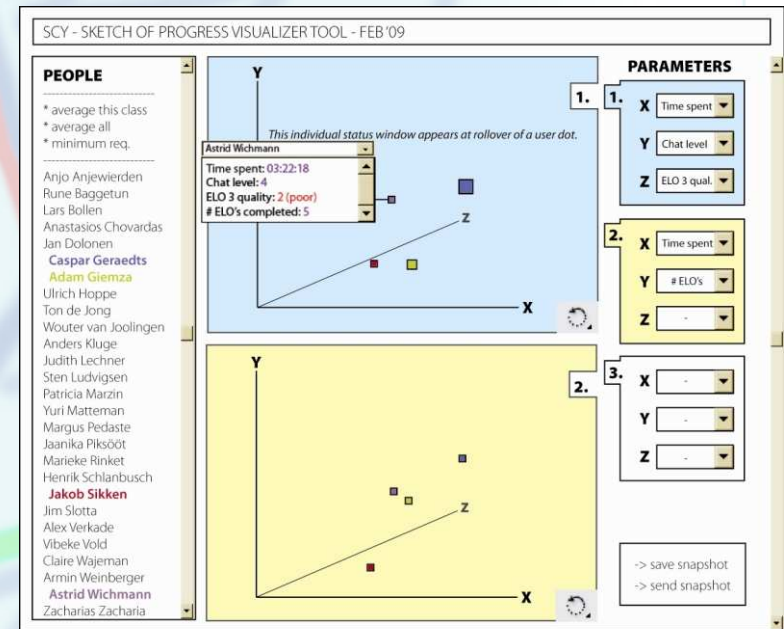
More to come

- ▶ Progress visualization
 - ▶ i.c.w. the mission map



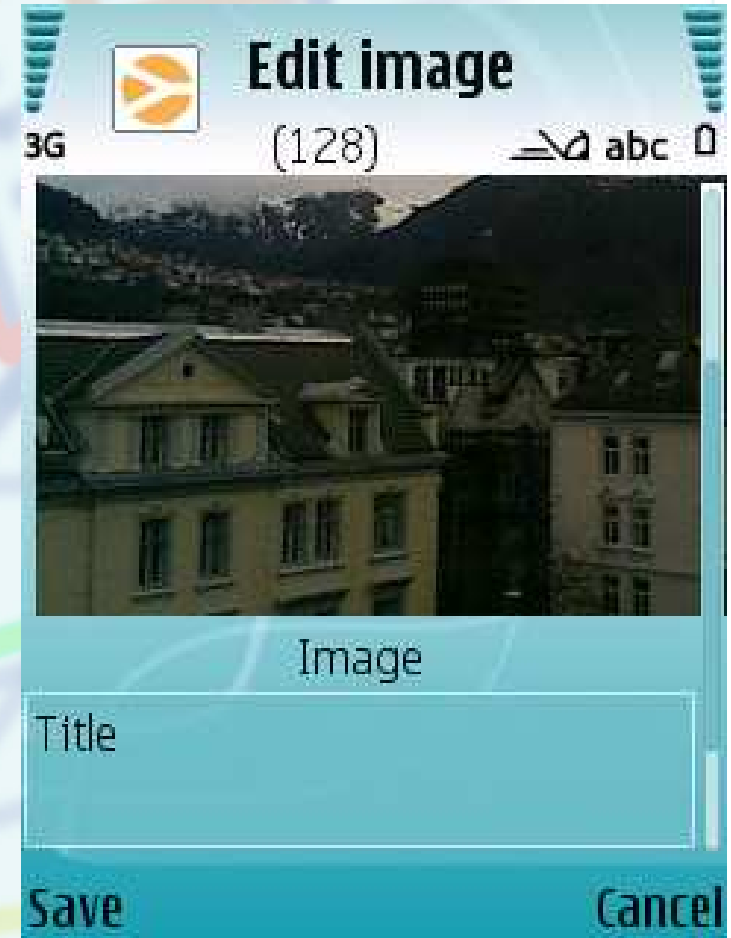
More to come

- ▶ Progress visualization
 - ▶ i.c.w. the mission map
- ▶ Cockpit view
 - ▶ For teachers (with WP VII)



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- ▶ Mobile tools



More to come

- ▶ Progress visualization
 - ▶ i.c.w. the mission map
- ▶ Cockpit view
 - ▶ For teachers (with WP VII)
- ▶ Mobile tools
- ▶ Interviewing

3. Specify variables

1. Formulate xxx
2. Identify xxx
3. Specify xxx
*Water usage
bathroom*
*Water usage
kitchen*
4. Formulate xxx
5. Formulate xxx
6. Design xxx

Your first variable is:
"Water usage in bathroom"

Now consider how you can measure this variable.
Write down possible indicators below.

Indicators of *"Water usage in bathroom"*

Shower time per person

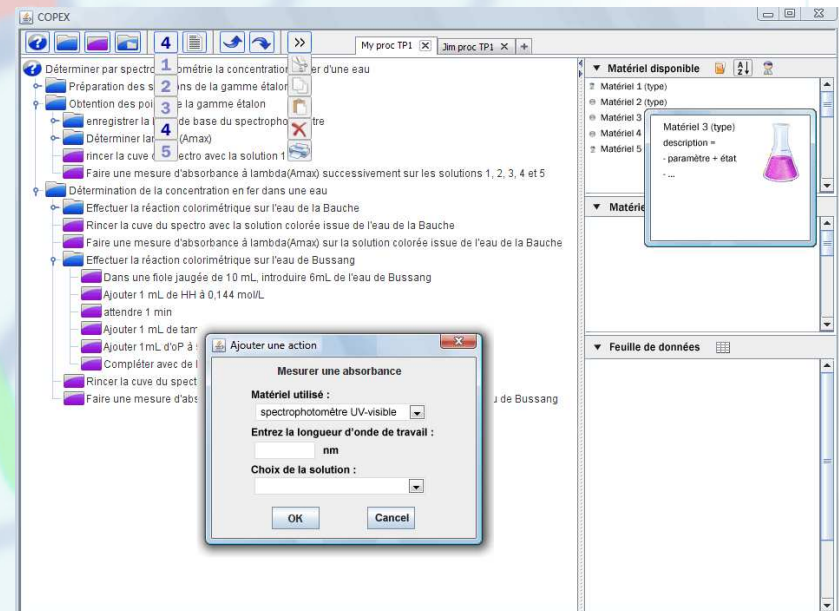
Shower frequency

◀ ▶ 🏠



More to come

- ▶ Progress visualization
 - ▶ i.c.w. the mission map
- ▶ Cockpit view
 - ▶ For teachers (with WP VII)
- ▶ Mobile tools
- ▶ Interviewing
- ▶ Experimental design
- ▶ And more

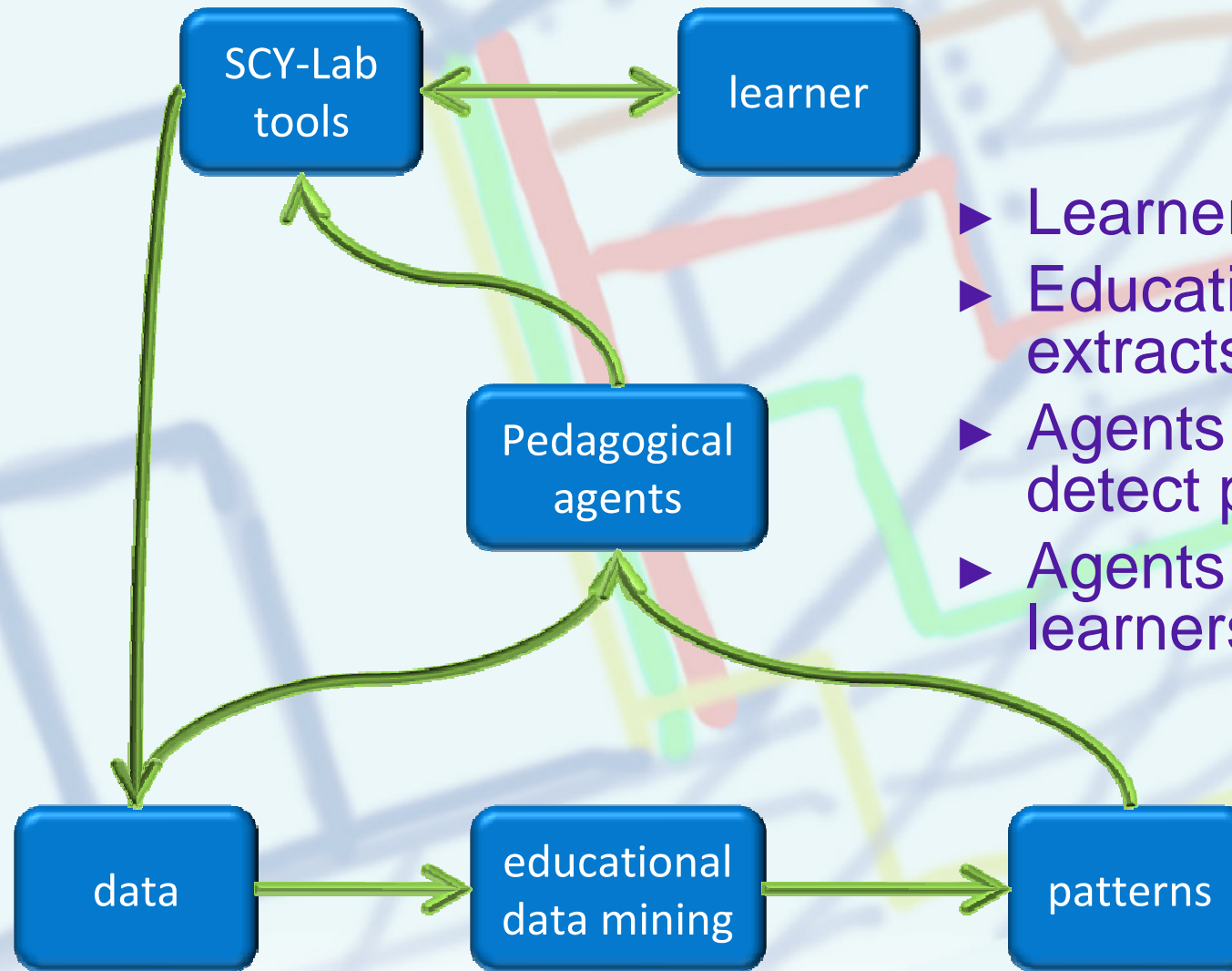


Pedagogical Agents

- ▶ **Small software agents**
- ▶ **Monitoring**
 - ▶ Products (ELOs)
 - ▶ Process (Actions)
- ▶ **Signal need for intervention**
 - ▶ Scaffolds
 - ▶ Offering information and tools
- ▶ **Technology**
 - ▶ Data mining
 - ▶ Pattern matching



Pedagogical agents - concepts



- ▶ Learners produce data
- ▶ Educational data mining extracts patterns
- ▶ Agents (are trained to) detect patterns
- ▶ Agents give feedback to learners

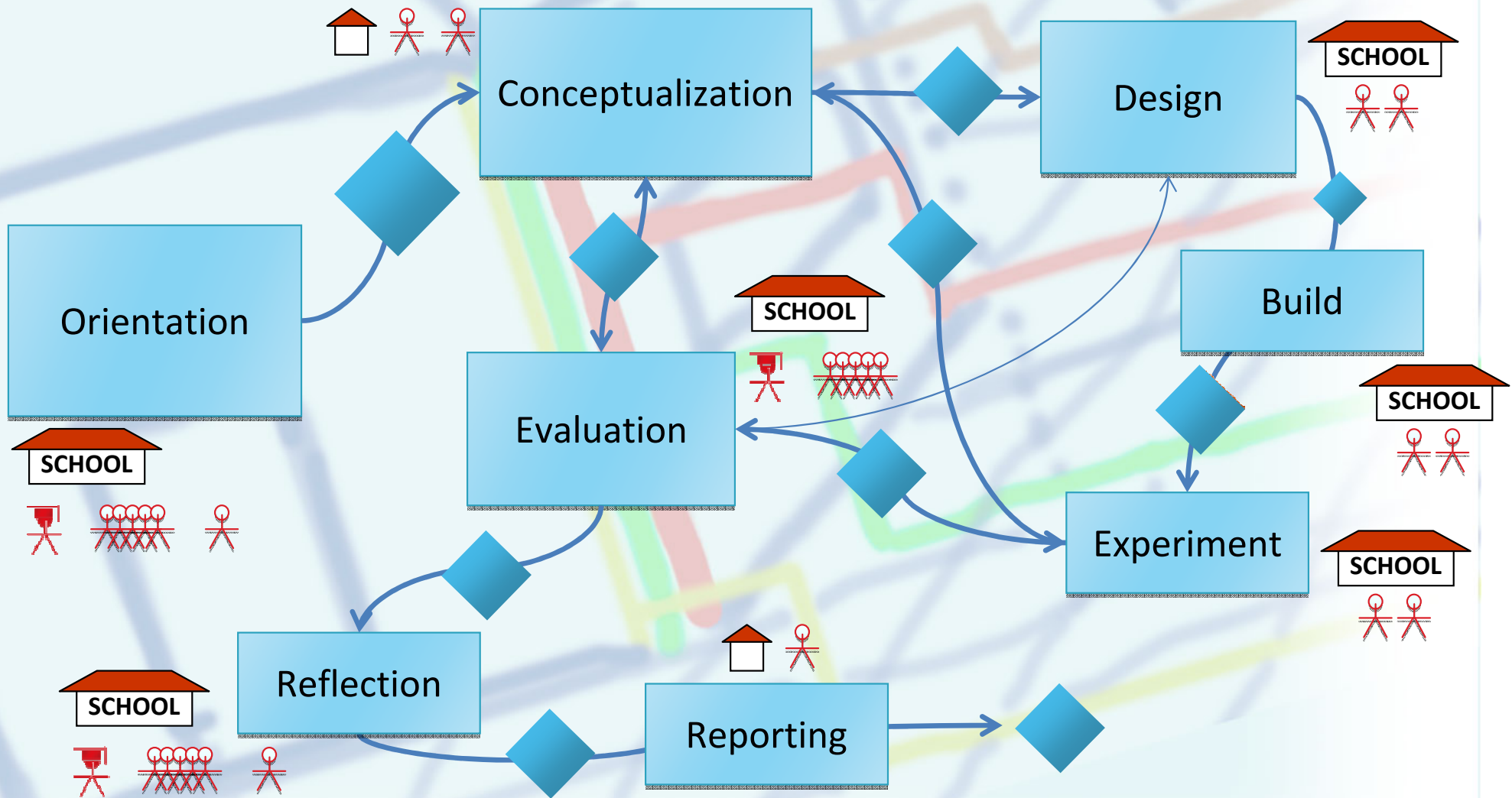


Advanced Pedagogical Approaches

- based on learners' activities
- collaborative and self-regulated
- anchored in authentic contexts and tasks
- learners using tools for creating sharable and usable products (ELOs)
- scaffolding, i.e. support adaptive to learners' advancing skills and knowledge



The Design Challenge



LAS – Learning Activity Spaces

- ▶ LASs are the building blocks for scenario design
- ▶ A LAS is a set of activities, scaffolds, tools and services
- ▶ A LAS defines anchor ELOs that represent required milestones in a pedagogical scenario
- ▶ LASs cluster thematically related learning activities in a coherent and intuitively conceivable way
- ▶ The thematically related activities inside a LAS can be freely exchanged to provide flexibility



Advanced Pedagogical Scenarios

DEBATE

INFORMATION

EVALUATION

DESIGN

REFLECTION

REPORT

ORIENTATION

MANAGEMENT

BUILD

EXPERIMENT

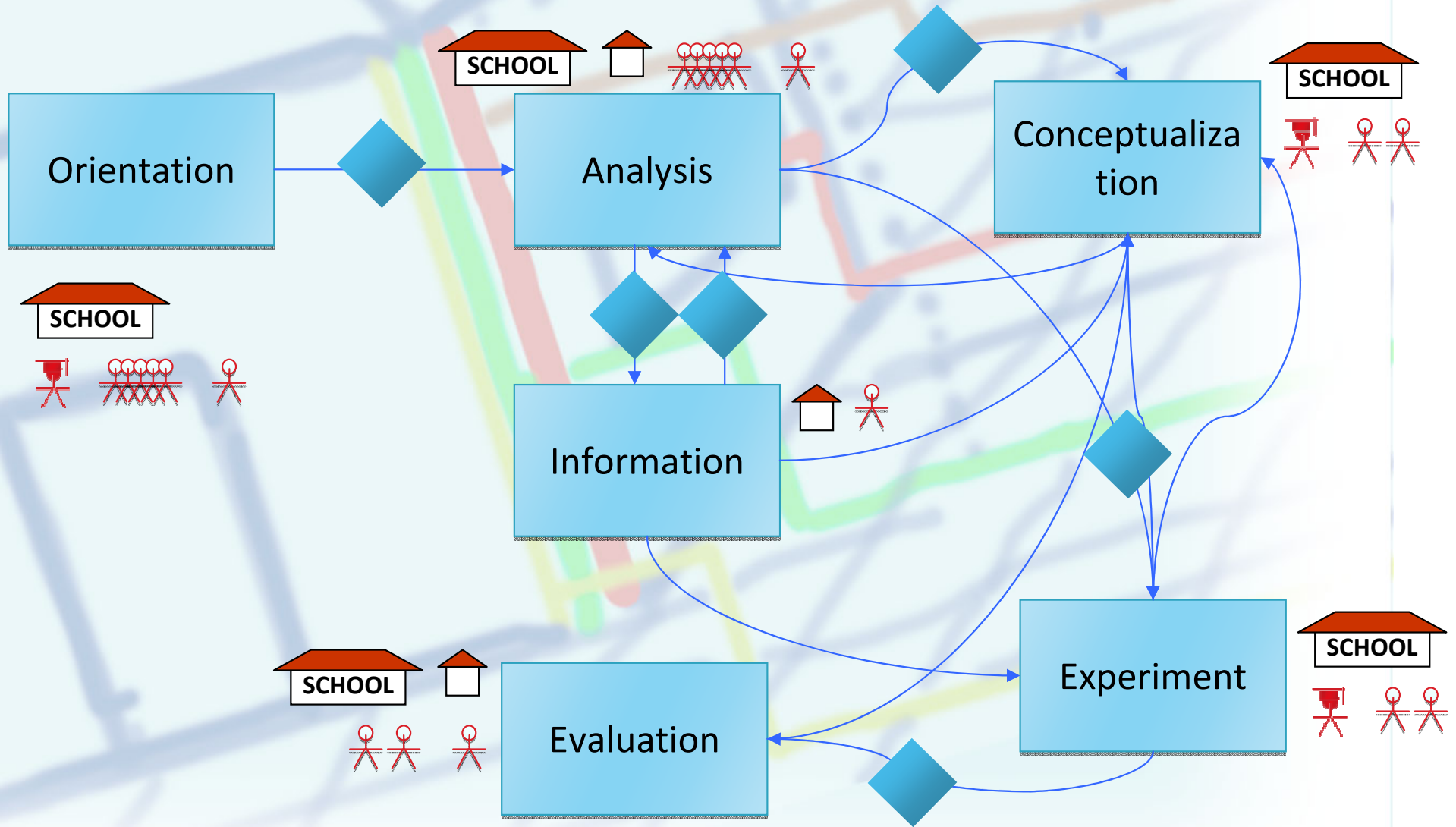
REGULATION

ANALYSIS

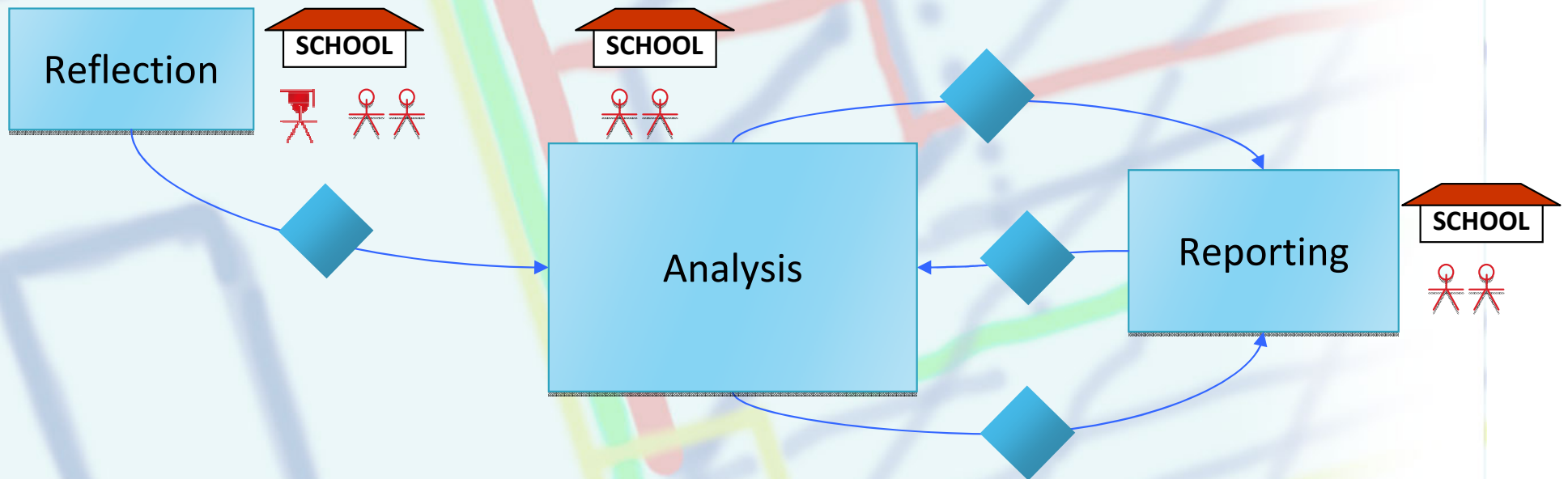
CONCEPTUALIZATION



Inquiry Learning



Decision console



LASs for the learner

SCV-Lab mission CO2 House

S CO2 Simulation

Architecture & Thermal characteristics of MyHouse

SIZE Walls Roof Floor Doors Windows Ventilation
Walls surface : 92.8 m²

Choose walls materials **Valid**

layer	material	thickness	U factor
Roughcast :	wood	2.0 cm	.73 W ^o C ⁻¹ m ⁻²
Structure	bricks	20 cm	1.7 W ^o C ⁻¹ m ⁻²
Insulation	styrofoam	17 cm	.04 W ^o C ⁻¹ m ⁻²
Plaster :	none	cm	W ^o C ⁻¹ m ⁻²

Heat loss coefficient of Mythouse

Results

Walls' U factor : 1.02 W^oC⁻¹m⁻²
Walls' heat loss coeff : 95.2 W^oC⁻¹
House's heat loss coeff : 168.8 W^oC⁻¹

M Model of Greenhouse

G CO2 Data

CO2 concentration

generated_by

displays

Background information

Created by YOU

Temp Dat

Temp Dat

Temp Dat

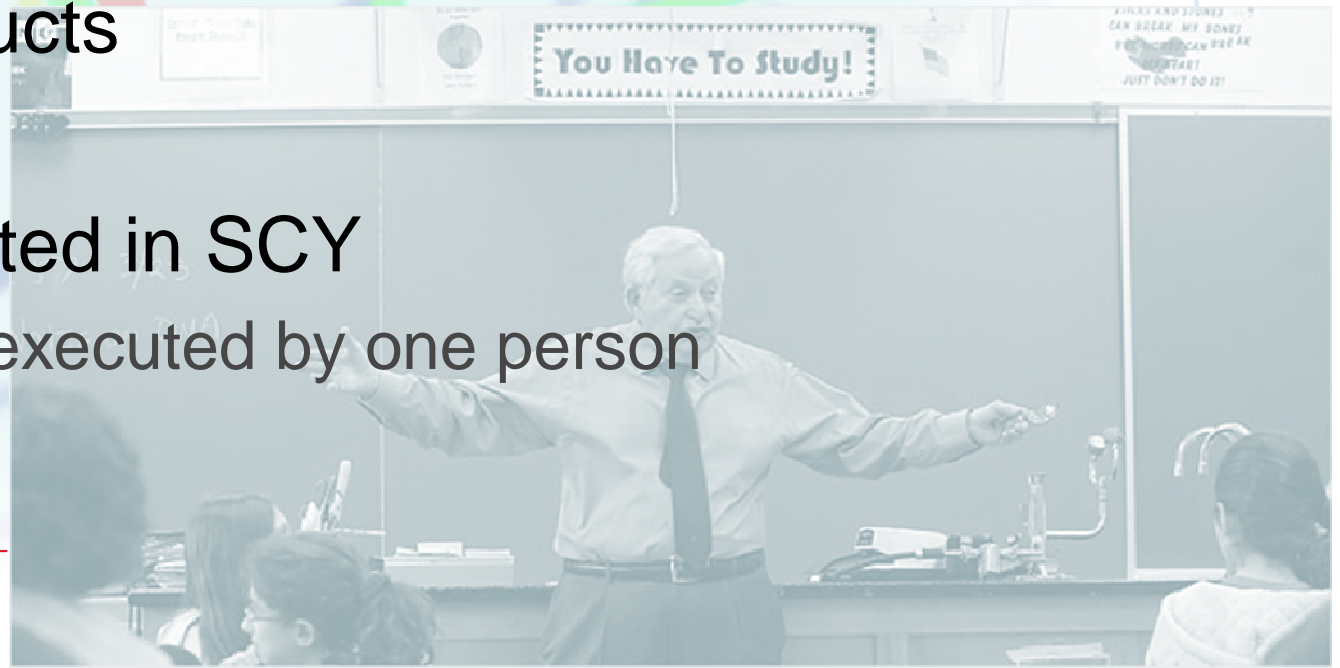
LASs

- ▶ **MAY**
 - ▶ Represent phases of learning
 - ▶ Represent logically grouped activities
 - ▶ Structure the learning process
- ▶ But definitively do not represent an enforced structure
- ▶ Gentle ride along the instructional guidance wave.
- ▶ Offer support without destroying the exploratory nature of the environment



Roles for the teacher in SCY

- ▶ Designer: tuning the learning environment for learners
- ▶ Source of knowledge during classroom discussion and work
- ▶ Coach/supervisor: providing hints and support for learners.
- ▶ Assessor of products
- ▶ Tasks are separated in SCY
 - ▶ And need not be executed by one person



SCY and the teacher - survey

▶ Teachers

- ▶ ... want to keep the fun in teaching
- ▶ ... want to be supported in routine tasks
- ▶ ... want support for differentiation
- ▶ ... need more time
- ▶ ... want to exchange data and documents



More SCY!

Assessment

- ▶ Portfolio-based assessment
 - ▶ Building ELO-based portfolio
 - ▶ Assessing portfolio
- ▶ Playful peer assessment
 - ▶ Learners assess each other's work

Authoring

- ▶ Building
- ▶ Editing
- ▶ Filling
- ▶ Pedagogical plans
 - ▶ Based on scenario
 - ▶ Tailored to a mission



SCY

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<http://www.scy-net.eu>

