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

Learning Science
- Universiteitet i Oslo
- Université Joseph Fourier

Educational Practice
- Universiteit Cyprus
- Technasium
- De Praktijk
- Universiteit Twente

Computer science
- ENOVATE
- Fraunhofer IAIS
- OISE
- Universität Duisburg-Essen
Who is SCY

- ENOVATE
- Universitetet i Bergen
- Universitetet i Oslo
- Universiteit Tartu
- OISE
- Technasium
- Universiteit Twente
- Universität Duisburg-Essen
- De Praktijk
- Fraunhofer IAIS
- Université Joseph Fourier
- Universteit Cyprus
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
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

A model of the temperature in a house

A hypothesis about energy

Temperature measurements

A function fitted to data

An annotated picture

A concept map
ELO Typology and Ontology

- **ELO Type**
  - **technical format**
    - text/plain
    - image/png
    - audio/mpeg
    - application/mword
    - ...
  - **logical representation**
    - list
    - table
    - sketch
    - photo
    - ...
  - **functional role**
    - dataset
    - hypothesis
    - concept map
    - petri net model
    - ...

- related activity
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

Services for communication, awareness etc...

Scaffolds are integrated in tools and SCY-Lab

Tools to produce and edit ELOS
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.)
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 services
- 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)
More to come

- Progress visualization
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► Progress visualization
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► Cockpit view
  ► For teachers (with WP VII)
► Mobile tools
► Interviewing

3. Specify variables

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
► 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

- SCY-Lab tools
- Pedagogical agents
- 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

Orientation

Conceptualization

Design

Build

Evaluation

Experiment

Reflection

Reporting
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
Inquiry Learning

Orientation → Analysis → Information → Evaluation → Conceptualization → Experiment

SCHOOL
Decision console

- Reflection
- Analysis
- Reporting
LASs for the learner
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