

# Integrative Science Education Courses at Heureka (The Finnish Science Centre)



## Main activities:

participating lectures, doing laboratory workshops, participating Science Theatre shows, doing Augmented reality workshops.

## Narrative:

The course, Integrative Science Education Courses at Heureka, consists of an introductory lecture, laboratory workshops, science theatre shows, augmented reality workshops and exhibition tour. The course that highlights the role of informal learning uses the Pre-visit – Visit – Post-visit –model as a pedagogical approach. The course integrates different natural sciences in a way that promotes an active learning process and intrinsic motivation.

- Lecture: Science Centre as an Open Learning Environment
  - introducing the Pre-visit – Visit – Post-visit – model
- Laboratory workshops (Open laboratory and Children's laboratory)
  - visit phase of the model
  - taking part to the laboratory workshops in a role of learner
  - doing experiments, cooperative learning, learning by doing, increasing motivation, the host of the show gives explanations based on evidence, other possible explanations are considered
- Participating Science Theatre shows (Why does not the cow fly?, Gas World)
  - pre-visit and visit phases of the model
  - taking part to the shows as a learner
  - pre-visit phase: teacher students' curiosity is provoked, they are asked questions of current knowledge, they are proposing preliminary explanations or hypotheses, proposing simple investigations
  - visit phase: teacher students do observations, the host of the show gives

## Summary:

The course, Integrative Science Education Courses at Heureka, consists of an introductory lecture, laboratory workshops, science theatre shows, augmented reality workshops and exhibition tour. The course that highlights the role of informal learning uses the Pre-visit – Visit – Post-visit –model as a pedagogical approach. The course integrates different natural sciences in a way that promotes an active learning process and intrinsic motivation.

## Aims:

The aim of the course is to introduce teacher students the pre-visit – visit – post-visit-model. The model activates informal learning during science centre visit by including both pre-visit and post-visit phases of learning. The model takes into account for instance following aspects of learning: orientation, focusing and preconceptions about a topic to be learned and motivation. Methods included are learning by doing and cooperative learning.

- explanations based on evidence, other possible explanations are considered
- Doing Augmented reality workshops
  - content: Doppler effect (see details in [www.osrportal.eu/en/node/95848](http://www.osrportal.eu/en/node/95848)) and Double Cone on the Tracks or Uphill Runner (see details in [www.osrportal.eu/connect.php?m=thenewviewer&nid=95914](http://www.osrportal.eu/connect.php?m=thenewviewer&nid=95914))
  - all phases of the model: pre-visit – visit – post-visit
- taking part to the Augmented reality workshops as a learner
- same kind of phases of pre-visit and visit like in participating Science Teacher shows
- post-visit phase: Communicate explanation, Follow-up activities and materials
- Familiarizing with the Heureka Classics exhibitions
  - all phasesofthamodel
  - see: [www.osrportal.eu/connect.php?m=thenewviewer&nid=95849](http://www.osrportal.eu/connect.php?m=thenewviewer&nid=95849)

<b>End user:</b> Teacher students	basic_education	Reality workshops by a feedback form.
<b>Involved actors:</b> Researchers and science center staff	<b>Languages available:</b> Finnish	In addition, they answer to an inquiry of science center and open learning environments. This best practice has been certified by the internal evaluation of the University of Helsinki.
<b>Location:</b> Heureka – The Finnish Science Centre	<b>Where to find the application or case:</b> Science Centre Heureka	<b>Duration:</b> Two days - course
<b>Connection with the curriculum:</b> Learning natural sciences at primary school, wide scope: <a href="http://www.oph.fi/english/sources_of_information/core_curricula_and_qualification_requirements/">www.oph.fi/english/sources_of_information/core_curricula_and_qualification_requirements/</a>	<b>Evaluation parameters:</b> The pedagogical approach, Pre-visit – Visit – Post-visit –model, is based on so called 5E-model that includes the main aspects of IBSE-learning. Teacher students give feedback of Augmented	

Teachers' Competencies		
1	subject matter/content knowledge	x
2	nature of science	x
3	Multidisciplinary	x
4	knowledge of contemporary science	x
5	variety of (especially student-centred) instructional strategies	x
6	lifelong learning	x
7	self-reflection	x
8	teaching/ learning processes within the domain	x
9	using laboratories, experiments, projects	x
10	common sense knowledge and learning difficulties	x
11	use of ICTs	x
12	knowledge, planning and use of curricular materials	x
13	Information and Communication Technologies with Technological Pedagogical Content Knowledge	x

# Mapping best practices with main principles



## 1. Building interest in natural science phenomena and explanations:

The course follows Pre-visit – Visit – Post-visit –model (also 5E-model) that activates students' interest and support the knowledge structuring process through different phases similar to scientific method. During the course the students get to know different natural phenomena by taking part to the laboratory workshops in a role of learner, doing experiments and learning by doing together with other students. See also principle 8.

## 2. Building up informed citizens:

Students understanding the nature of Science @ Science in society:

The whole course is organised in a science centre. During the course the students get to know different aspects of nature of Science: geology, mechanics, chemistry and biology. Science in society is approached e.g. from the standpoints of crime, traffic and economy: Murder in Heureka, Heureka Classics, About a Coin, Intelligent Traffic. See also principle 3.

## 3. Develop multiple goals:

- understanding big ideas in science including ideas of science, and ideas about science
- scientific capabilities concerned with gathering and using evidence
- scientific attitudes

- to understand different aspects of doing science in different fields of phenomena (e.g. exhibit Science Changing the World or planetarium show Journey to the Stars)
- to learn to use scientific method and discuss about science (e.g. The Children's Laboratory Colourful Chemistry and Science Theatre Gas world, Augmented reality Mechanics)

## 4. Understanding students' concepts and learning style about of science phenomena:

Using Pre-visit – Visit – Post-visit-model and 5E-model as a structure of the course support students' learning process.

## 5. Relevance of the content to daily life of students:

During the course students get a chance to approach the natural phenomena from many perspectives familiar to daily life. For example exhibits of traffic (Intelligent Traffic) and economy (About a Coin), science theatre of flying (Why does not the cow fly?) offer a new stand point for science in daily life.

## 6. Understanding science as a process not as stable facts. Using up to date information of science and education:

The main learning results related to informal learning and especially to science centre education are related to the motivations' effect on learning. (Salmi 1993, 2003; Falk 1993; Salmi 2010). Intrinsic motivation refers to a real interest in the topic studied. Furthermore, the course also supports students' knowledge structuring process through different phases of concept formation. During the course the students learn processes of natural sciences for example in Augmented reality Physics workshops.

## 7. Activities for gaining knowledge, not for entertainment, nor for simple imitating of results:

The course supports active learning by 1) guiding to empirical concept formation and 2) promoting intrinsic motivation. During the course students learn how to make observations, how to apply empirical testing and hands-on experimenting. These activities together with the multifaceted tour through the science center also increase students' levels of intrinsic motivation. Especially hands-on workshops guide students to the direction of active knowledge gaining. For example: In the laboratories, The Open laboratory and Children's Laboratory, the aim of the laboratory programmes is to introduce children to and interest them in experimental natural science observation and teach them about chemical research topics and work methods. In the Children's Laboratory and the Open laboratory teams of two work together under the guidance of a Heureka inspirer.

## 8. Doing science: experimenting, analyzing, interpreting, redefining explanations:

The pedagogical approach, Pre-visit – Visit – Post-visit-model, includes following phases:

1. Pre-visit: Provoke curiosity, Define questions from current knowledge, Propose preliminary explanations or hypotheses, Plan and conduct simple investigation
2. Visit: Gather evidence from observation, Explanation based on evidence, Consider other explanations
3. Post-visit: Communicate explanation, Follow-up activities and materials

## 9. Assessment: formative ~ of students' learning and the summative ~ of their progress:

As an assessment tool is used Hermant's (2003) New educational model or paradigms –cycle. The aspects of 1) Changes in learning environments, 2) Role of ICT and 3) Innovative learning approaches are evaluated.

## 10. Cooperation among teachers and with experts:

The course is planned and organised in cooperation with researchers of Science Center Pedagogy Unit in Teacher Education Department of HU and educators of Science Center Heureka.