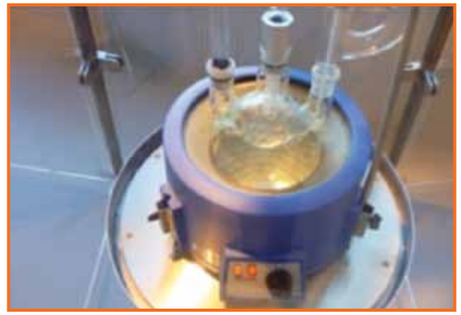
Collaborative Learning, Creative and Innovative Teaching (CLCIT)

Acceleration measurements in amusement park, Prater in Vienna



Simple model of a geyser in the WELIOS science center, Wels

Summary:

There are a number of fundamental key elements to the development and carriage of this best practice. There is a focus on highlighting the available resources that can be used to stimulate the learning, concentrate the learning structure on IB methods to transform the learning process, identify the appropriate people who will aid and are the recipients of this learning process and finally and most importantly developing the synergy whereby the resources are utilised by people to engage in the learning process. Therefore sensor systems and mobile devices are used in real life environments (outdoor and indoor activities) in cooperation with a museum or science center.

Aims:

This best practice focuses on using stimulating experiences for the learner within an IB framework and sharing those experiences amongst the learning community to provide encouragement and further stimulus. By highlighting events that take place at science centers for example, actors and end users will be exposed to the methodology and positive results of this best practice. The main aims are to

- provide applicable introductions and working materials for teachers, museum/science centre/ scientists pedagogies and learners.
- intensify cooperation with museums/science centres in order to plan and conduct experiments and for didactical support.
- give students the opportunity to explore their own way of learning and researching in order to foster their key competences and self-responsible acting by using sensors and mobile devices.

Main activities:

- Excursions (field trips): Involving upper school students and teachers using museum/science centres or other theme based sites to test and practice technologies within a pedagogical structure.
- Forums: in conferences, museums/science cafés/ presentations and educational institutions where teachers, students and other members of the academic community are informed about the current collaboration possibilities and have the opportunity to participate in events organised by experts in their field, such as scientists.
- Workshops, where teachers and trainee teachers have the opportunity to be trained or mentored in new technologies and pedagogical practices for use in the learning process. An important by-product of these workshops is the development of learning scenarios available for use in schools and also in some cases community organisations.
- Contests, with the aim to foster the collaboration between science centers/museums and schools (teachers and students). In cooperation between pedagogues in museums, teachers and students scientific topics presented in the museum/ science center should be didactically adapted in order to design curriculum-conform material. Furthermore these activities outside school convey students' creativity and self-dependend learning process.

Narrative:

Collaborative trainings, workshops, events, excursions in cooperation with museum, science centres and scientific institutions are appropriate to include and use existing results (repositories, educational materials, e-learning tools, etc.) in the learning process of an inquiry based framework.
Following topics could be covered:

- Astronomy/Astrophysics,
- Physics and Chemistry,
- Biology,

which could be also combined (e.g. extraterrestrial life: biology and astronomy). The current methodology is inquiry based teaching which also includes problem based learning. This learning focus is delivered through practices such as collaborative learning, problem solving and systems approaches and is evident in current initiatives such as RUeNTER, pSkills, Open Science Resources, Discover the COSMOS and KLiC. In adopting inquiry based learning the ministry aims to embed the process of the Inquiry Cycle

Mobile experiments

- Inquisition
- Acquisition
- Supposition
- Implementation
- Summation
- Exhibition (Llewellyn,2002)

into the everyday practices of teachers and then by a dissemination and exploitation process outlined in the activities above to other teachers and educators within the network of schools. Learning Management Systems (LMS) are provided for teachers, students, parents and other interested people with an access designed for specific users. The establishment of the LMS enables an eLearning platform to be implemented.
Learning that is enabled by the adoption of digital technologies is a core foundation of this best practice. The power and ability of the eLearning structure to add value is based on the process to add value, make sense of and re-create the information (Garrison & Anderson, 2003). Hence promoting innovative approaches such as

- mobile learning with mobile phones and tablets,
- using smart technologies such as interactive white boards as well as sensor systems and
- adopting blended learning strategies that allows for a blend of face-to-face teaching and distance learning

better meets the needs of the learner.

References

Garrison, D.R., & Anderson, T. (2003). E-Learning in the 21st Century: A Framework for Research and Practice. London: Routledge

Llewellyn, D. (2002). Inquire within: Implementing inquiry-based science standards. Thousand Oaks, CA: Corwin Press

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End user:
There are three distinct groups that can be identified as primary end users:

1. teachers and trainee teachers who will be targeted to provide education in this particular mode of learning and
2. the students (age 10 to 18 years) who will be the recipients of the planned learning style and material.
3. the museums pedagogues who will learn on how to prepare their materials with IBSE strategies, and how to collaborate more effectively with schools. The general public shall be involved in events, in forums, and general demonstrations of the technological and pedagogical tools.

Involved actors:
Apart from the end users, other actors are described as the people who will act as the providers, conduits of the ideas and concepts of the proposed learning style and materials to the end user. Ostensibly, when the context of the project involves a country then the number of people involved is large and diverse and are identified below

- upper school students
- natural science teachers (physics, biology, chemistry), as well as teachers of other subjects and interests, like astronomy
- trainee teachers (teacher students)
- personnel at museum/science centers (i.e. museums pedagogues)
- scientists
- colleges of education (particularly teacher trainers)
- informal learners, and other interested people

Location:

- Academic Institutions
- Science Centers, Museums
- Schools
- Universities
- Observatories

Connection with the curriculum:
The areas of the formal school curriculum are indicated in deliverable D5.2 (for the complete secondary school curriculum see www.bmukk.gv.at/schulen/unterricht/lp/lp_ahs_oberstufe.xml)

Languages available:
German and/or English

Where to find the application or case:

- Observatory of the University of Vienna, Department of Astronomy, Vienna: astro.univie.ac.at
- TMW, Technisches Museum Wien, Vienna: www.tmw.at
- WELIOS science centre, Wels: www.welios.at
- CERN, Geneva: www.chern.ch
- Other museums/science centres/scientific exhibitions with suitable installations (hands-on, etc.)
- OSR-Portal: www.osr-portal.eu
- Virtual School Platform: www.virtuelleschule.at

Evaluation parameters:
We have selected to the selection criteria, specified in deliverable D5.2a framework for identifying best practices in inquiry-based science education.

1. apply universally
2. can be developed through a variety of content, chosen to be relevant, interesting and motivating
3. can be applied to new content and enable learners to understand situations and events, as yet unknown, that may be encountered in their lives.
4. have explanatory power in relation to a large number of objects, events and phenomena that are encountered by students in their lives during and after their school years
5. provide a basis for understanding issues involved in making decisions that affect their own and others' health and wellbeing, the environment and their use of energy
6. provide enjoyment and satisfaction in being able to answer or find answers to the kinds of questions that people ask about themselves and the natural world
7. have cultural significance.

Duration:
The duration of the best practice is open ended, but the duration of single events with appropriate periods of preparatory work and post-processing (both could be in the classroom) is one up to three days. Following events are already chosen for the school year2011/2012 to carry out a best practice activity in Austria

Additional information or resources:
Results and learning materials from science projects collected and optimized over the last years on www.virtuelleschule.at or www.schule.at/gegenstand/visor www.virtuelleschule.at/wiki or www.virtuelleschule.at/moodle, e.g.:

- Cosmos: www.virtuelleschule.at/cosmos;www.cosmosportal.eu
- Learning with ATLAS@CERN: www.virtuelleschule.at/atlas; www.learningwithatlas-portal.eu
- InLoT/KLiC: www.virtuelleschule.at/klic; www.ea.gr/ep/klic
- OSR: www.virtuelleschule.at/osr; www.osr-portal.eu
- pSkills: www.virtuelleschule.at/pskills;
- Organic.Edunet: www.virtuelleschule.at/organicedunet; portal.organicedunet.eu
- CerOrganic: www.virtuelleschule.at/cerorganic; www.edumoodle.at/vis/course/view.php?id=15; cerorganic.moleportal.eu

Acceleration measurements at summer bob drives, Igls in Tyrol

The great refractor (68cm lens and 10.5 focal length) at the observatory of the University of Vienna

Mobile learning in the Technical Museum, Vienna

Control room at the ATLAS visitor center, CERN

Teachers' Competencies

1	subject matter/content knowledge	x
2	nature of science	x
3	Multidisciplinary	x
4	knowledge of contemporary science	
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

PATHWAY

1. Building interest in natural science phenomena and explanations:

The selection of the topics as well as the way how the topic will be introduced (by experts, 3D shows, installations at exhibitions, mobile learning applications, etc.) is given to build interest. Each topic is facilitated and guided by an expert, a scientist or pedagogical staff at museums or science centres.

2. Building up informed citizens: Students understanding the nature of Science & Science in society:

Informal science centre visitors will be invited to events, science cafés, and to public demonstrations or open science-centre days. Activities give students the opportunity to plan and organize their own way of exploring, learning and presenting results. In the framework of workshops and contests they work with the support of experts where they train their researching competences (searching relevant information, preparing information for others).

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**

Science cafés, events with scientists, science centre visits shall contribute to reflect on stereotypes related with natural science in students, and in the informal learners. The pedagogical structure of the selected best practices focuses on gathering evidence from observation (at scientific institutions or from experiments) and leads to a deepening of the learnt concepts. The long-term objective is to improve the image of natural science.

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

The involvement of pedagogical trained people as well as scientists from the beginning of each best practice activity ensures that the learning cycle will be closed (more or less) for all learners. The learner's concepts and learning style of science phenomena will be treated in terms of the conceptual, didactical, physical and mathematical point of view as it is necessary for the learner's knowledge.

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

The best practice ensures the connection to daily life and daily experiences due to the considerations made in the used learning pathways, e.g.

- Gravity and acceleration: forces on the human body
- Weather and climate in the troposphere: forecast and prediction with help of measurements of physical parameters and observations e.g. of satellites

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

Astronomy and physics are one of the main topics of the best practice, which shows in a very impressive way that science as a process is not science as stable facts. A lot of research fields are a steady discovery of new facts and theses of more and less complex natural phenomena (e.g. cosmology, formation and evolution of stars and planets, extraterrestrial life).

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

Study trips to museums/science centres. Experiments, supported by the use of new technologies (mobile Learning). Project related tasks in the course of the school curriculum to reflect learnt concepts and to stimulate the development of further questions.

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

Some aspects of the best practice concentrates also on the historic thinking of scientific research, how ancient scientists did their experiments and how they interpreted their discoveries in the context of their historic surrounding (political, social and science), e.g. Newton, Kepler, Galileo.

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

Assessments are included in a variety of types and times where they occur, which provide feedback of the learning process and its progress. Each activity contains self-learning, presenting and informing, experimental and reflecting and assessing parts, e.g. a self test is implemented at the end of each mobile learning application. The teachers have to observe the learners all the time and react to support the learning progress.

10. Cooperation among teachers and with experts:

The collaborative nature of this best practice ensures the cooperation among teachers as well as with scientists and museum/science center pedagogies and staff. The aim is to construct a network in which it should be easy for teachers to contact experts for an selected subject or scientific topic.