Natural Europe: Natural History & Environmental Cultural Heritage in European Digital Libraries for Education

PATHWAY

Summary:

This best practice links the natural history museum to the classroom through engaging, hands-on, physical or virtual educational activities that promote a greater appreciation of nature and understanding of science.

Aims:

- To increase the student involvement in the educational process. Students hold the most significant role in this procedure, as they manage the activities organized according to their educational needs. The teacher acts as facilitator, supervising students' interaction and assisting when necessary.
- To connect formal and non-formal learning in real-world and digital environments. Based on entertainment and education, this approach allows school students to enjoy an educational experience tailored to their own needs and expectations, under the guidance of their teacher.
- To provide fascinating opportunities for interaction with natural history-related physical and digital objects and resources. Digital and physical museum exhibits, being an integral part of the educational procedure, influence positively the students' curiosity and urge to learn, and thus enhance their interest towards natural sciences.

Main activities:

Teachers and museum educators work closely to design stimulating lesson plans, corresponding to the national curriculum, and adaptable to the students' personal needs. These lesson plans are based on a museum visit, whether physical or virtual, to engage students in hands-on activities leading to realistic experiences directly connected to classroom-taught science. In the same context, each lesson plan includes activities to be carried out prior to the visit and others following it. A major part of this procedure is student to student collaboration, a fact that reinforces assimilation of knowledge in a constructive way.

Narrative:

This educational approach aligns with the recommendations of the High Level Group on Science Education (Rocard, 2007) for the provision of increased opportunities for cooperation between formal and non-formal educational institutions for enhancing motivation and participation. An educational activity includes three phases: the pre-visit phase including actions that are being carried out prior to the museum visit, the visit phase regarding activities to be actualized in the museum (whether virtually or physically) and finally the post-visit phase concerning follow-up activities to take place upon return to classroom. Each of the three phases is divided in carefully designed steps. The overall procedure is very well structured to ensure maximum learning results; when following closely all the steps, students can obtain knowledge and develop an understanding on the issues discussed.
Overall, students work in teams to explore theory, make observations and collect data within realistic contexts. This procedure allows them to identify and fill gaps in their knowledge base through hands-on activities. Students work out relationships of cause and effect, using reasoning ability, to interpret collected observations.
e.g. RENEWABLE, GREEN, CLEAN? Wind Energy & Solar Energy (PV) [http://education.natural-europe.eu/natural_europe/exhibits/pathway-slug-53/to-begin-with]
This activity, which is addressed to students of Key Stages 2-3, regards two renewable energy forms (solar power and wind power) and their advantages and disadvantages. Students work collaboratively to investigate the issue, pose questions according to prior knowledge, make their own connections to the information discovered and reach conclusions. All the steps revolve around a visit to a science centre for environmental education, where students can engage in creative activities and achieve deep understanding on the issue examined.

Methods of learning supported:
inquiry-based – game-based
End user:
students of primary and secondary education
Involved actors:
Primary and secondary education students and teachers, museum educators, science communicators
Location:
Formal and non-formal institutions (schools, Natural History Museums, Science Centres, Botanical and Wildlife Gardens, other fields e.g. forests, rivers, excavation sites)
Connection with the curriculum:
Natural Sciences (Physics, Biology, Chemistry etc.)
Languages available:
English
Where to find the application:
http://education.natural-europe.eu/natural_europe/
Evaluation parameters:
this educational approach is based on the inquiry-based learning model, which aligns with the recommendations of the High Level Group on Science Education (Rocard, 2007) for the provision of increased opportunities for enhancing motivation and participation.
Time frame:
1 hour to 2 weeks
Number of participants*: up to 20
Additional information or resources. The handbook and manual, addressed to teachers and aiming to exemplify the creation of educational activities in the context of this best practice, can be found following these two links: www.natural-europe.eu/files/Natural_Europe_Pathway_Authoring_Tool_Manual_151211.pdf www.natural-europe.eu/files/Natural_Europe_Educational_Pathway_Handbook_151211.pdf

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	
7	self-reflection	x
8	teaching/ learning processes within the domain	
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 focus of the educational activities is set on the educational needs of students in primary and secondary education in the fields of natural history, environmental education and science. Whether through web access to the portal or through physical visits to local NHMs, participating students engage in hands-on and minds-on educational activities that effectively link the modules taught in the classroom to practical, everyday life, issues.

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

Students engage in activities regarding the natural environment and natural history, which help them to become active and responsible citizens, both locally and globally. This way, an integrative approach is developed, building up networks to exchange new ideas and expertise and to create a common pool of new specific media. Moreover, they follow a clearly scientific approach to perform research and reach conclusions, and thus learn to appreciate the nature of science. The process involves understanding different perspectives of boys and girls and aims to boost gender equality.

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**

The Natural Europe educational model is thus structured to promote research initiated by the students. In this context, students are encouraged to work on their own questions, explore and work cooperatively to gather the required information and propose possible responses. A crucial part of this procedure is the students' own experiences, further enriched during this process, to allow them to develop thorough understanding on the issue examined. This way, engaged students comprehend the importance of scientific research for forming scientific answers to scientific questions.

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

The learner-centred approach is well-structured and aims at building knowledge on issues related to environmental protection, science, biology and chemistry. Following the inquiry-based model, the activities promote active, collaborative and community-based learning. Seeing that learners understand the messages of interest according to their experiences and interactions during the learning procedure; therefore, they are allowed to investigate the issues of their choice, answering their own questions.

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

This is achieved by organizing field trips to museums to engage students in hands-on experiments and 'minds-on' activities related to everyday life, as well as problem-solving approaches, heavily involving "real-life" experimentations in the user-friendly and engaging environment of the museum. The field trips are organized in such a way to enable users to live their individual learning experience. During the activities the initial predictions of the visitors can be tested against data made available to them during the visit.

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

The educational procedure followed requires completion of certain steps in order for students to understand the issues discussed, and examination of the initial predictions made against understanding obtained in later stages of the learning process. Moreover, the activities require use of digitized cultural resources from the European NHM community, as well as of state-of-the-art digital tools.

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

Hands-on and minds-on activities are at the core of this approach. Following it, students comprehend the issues discussed, and perform research according to their individual needs. The three-phase approach involves examination of the issue discussed by carrying out activities both in formal and non-formal environments, allowing for knowledge to be obtained progressively.

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

Students are expected to engage in hands-on activities, analyse their results, engage in discussions, and re-examine their beliefs as new information is being obtained. Both genders equally participate in this process of scientific experimentation and research, thus boosting gender equality.

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

Carrying out the activities, students always find themselves in the position of constantly evaluating their progress, investigating additional resources and looking for alternative answers. In the closing step, they are expected to examine the information retrieved and come up with a conclusion to be presented to their peers and their teacher who can understand and evaluate the process followed, the overall engagement and the understanding obtained.

10. Cooperation among teachers and with experts:

Teachers work collaboratively with museum educators in order to construct and carry out appealing educational activities. Putting together their expertise, they manage to engage students in truly interesting learning activities.