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# E-LEARNING FROM NATURE THROUGH E-LESSONS

## **Abstract**

The article is a study based on the e-Learning from Nature project funded by the European Commission. The project's main objectives are centred on improving students' low achievement and stimulating secondary school students' interest in science subjects. The article focuses on scientific education and its challenges and suggests an innovative approach which connects science with nature. It examines one of the most important project outputs: the e-lessons (short video lessons) created within the European partnership and the way they can contribute to increasing students' motivation to learn science. Participant teachers' testimonials have also been considered in the general evaluation of this project output.

nature  
science  
students  
innovative method  
e-lessons

## **The European context**

The unprecedented development of science and technology is a constant feature of our society. Their influence on our lives will undoubtedly continue to increase in the next years. Although a basic understanding of science and technology has become crucial nowadays students' interest in these subjects is very low. Students' enrolment in scientific and technological studies is also decreasing. Many countries have had a long period of steady growth in female participation in traditionally male fields of study, but this positive trend seems now to have been broken in some countries (especially Nordic countries). Science teachers need to break down stereotypes about science and reverse the traditional science-teaching pedagogy from mainly deductive to inquiry-based methods which will stimulate students' innate curiosity and make them look for answers (Colibaba, A., 2017).

## **The E-learning from nature project: target groups, objectives and methodology**

The E-learning from nature project addresses Science and English secondary school teachers as well as secondary school students (aged 14 to 19). Its prevailing objective is to increase students' low achievement in scientific subjects and motivate them to study science. The project aims to create e-learning resources in order to demonstrate students the relevance that science has in our lives as it touches all aspects of life in modern society: the workplace and the public sphere as well as the private sphere and our leisure time (Colibaba, A., 2017a).

The E-learning from nature project proposes an innovative method meant to enhance students' motivation to learn science. The innovative project methodology draws on several methods such as outdoor learning, peer learning, inquiry-based learning and e-learning. Peer learning involves the sharing of knowledge, ideas and

experience between the participants. Peer learning can help students learn effectively and it offers them the opportunity to learn from each other. The benefits of peer learning in extracurricular activities are similar to the benefits of peer learning in a formal learning environment as well. Students learn a great deal when organizing and planning these activities, explaining their ideas to others, working collaboratively with others or evaluating their experience. Peer learning has been used in the e-nature project as it suits a variety of contexts and school subjects. It enables students to practice and take responsibility for their own learning and teach them to learn how to learn ([http://enature.pixel-online.org/learning\\_science\\_EL.php](http://enature.pixel-online.org/learning_science_EL.php)).

In inquiry-based learning students' questions, ideas and observations are placed at the centre of the learning process. Teachers' role is to raise students' interest in the topic and fuel their curiosity. They have to know their students' needs and guide them through the learning process, which becomes challenging and exciting by problem finding and creative problem-solving.

E-learning meets the needs of modern-day learners. E-learning makes use of modern technologies and definitely enhances students' interaction and motivation in the classroom. Outdoor learning is a generous term that includes: environmental education, school projects, recreational and adventure activities, trips and expeditions, team building, or adventure therapy. It demonstrates that outdoor direct experience is motivating and has a great impact on students. In outdoor learning participants learn by doing - from what they do, see, encounter or discover outside the classroom. Participants learn about nature themselves or from others (peer learning). Outdoor learning can bring life to many school subjects while also fulfilling the aim "to enable pupils to respond positively to opportunities, challenges and responsibilities, to manage risk and to cope with change and adversity" ([http://enature.pixel-online.org/learning\\_science\\_EL.php](http://enature.pixel-online.org/learning_science_EL.php)).

The project is also in tune with holistic education which is based on the idea that each person finds identity, meaning, and purpose in life through connections to the community, to the natural world, and to spiritual values such as compassion and peace. Love of learning is achieved through direct engagement with the environment. Holistic education responds to the diverse learning styles and needs of evolving human beings ([http://enature.pixel-online.org/learning\\_science\\_EL.php](http://enature.pixel-online.org/learning_science_EL.php)).

The project combines all the above-mentioned methods, which are applied to a natural and familiar environment where the subject to be dealt with is introduced by the teacher or a guest specialist in the field. The main science concepts are embedded in the environment and revealed one by one by the teacher at students' request. Nature turns into a stimulating open laboratory, very useful to teach a huge number of abstract concepts. The project's methodology connects science to nature and makes good use of the surrounding natural elements, which are useful resources in the teaching and learning process. The learning process becomes an interesting journey of knowledge supported by hands-on experiments and programmes as well as state-of-the art technology (Colibaba, A., 2017b). Students not only participate in the process but also monitor its course according to their own interests. Participation is not limited to questions or answers but has several forms depending on everybody's creativity and power of expression. Everything is filmed and the results are a wide range of materials culminating in the short video lessons.

### **E-learning from nature project (e-lessons)**

The e-lessons created rely on interesting natural sites existing in each partner country (parks, gardens, nature reserves, lakes, mountains or hills). In most cases the lesson starts outside and the learning process is triggered by a natural element.

There are 130 e-lessons, which are in fact short films based on intriguing natural places. The project offers a collection of high-value resources and strategies to promote the teaching and learning of scientific subjects. The set of e-lessons proves that it is possible to address educational needs taking full advantage of nature's potential: Nature provides places where to carry out school activities with significant results as well as a wide range of interesting topics that capture students' attention. The films focus on a wide range of topics: fauna and flora in common ecosystems or nature reserves, challenges nature faces (extinction, pollution), changes in the climate and their effects, how to calculate the height of trees, mountains, towers/age of trees, explanations of natural phenomena or natural curiosities: the Devil's Bit (IE), Repedea Hill (RO), Fucecchio marshes (IT) ([http://enature.pixel-online.org/learning\\_science\\_EL.php](http://enature.pixel-online.org/learning_science_EL.php)).

The scenario of each film is simple and it is meant to engage students in the learning process. The first stage is to create links between natural elements and school scientific activities. For instance, a lake in the neighbourhood of the city may be the reason for a field trip where students are invited to observe the geographical and biological details of the lake (Colibaba, A. et al, 2017). The place is a natural monument thanks to its beautiful surroundings and rare species of fish. Then students are introduced to the water treatment

plant Chirita and to the complicated process through which water is treated and purified for drinking water production. Students learn about the main stages of the fully automated technological process through which the water of the lake becomes drinkable in a very concrete and natural way. Information from biology, geography and chemistry creates a complete picture of Chirita Lake (Colibaba, A., 2017a). Biology is one of the subject topics that explain natural events. However, some studies claim that the level of association between real life events and biology teaching is in fact very low. This can be surpassed by using the “outdoor learning” method, with lessons held in the middle of nature, highly appreciated by students. As a result, a set of videos comprise a wide range of biology topics such as: “A river ecosystem”, “A terrestrial ecosystem” and “Ecological succession: Mata do Quadraçal”. One of the films demonstrates the importance of the diversity of aquatic invertebrates in the protection and conservation of rivers (the Tuela river), whereas another one was shot to demonstrate some food chains of the aquatic ecosystems. With the activity “A terrestrial ecosystem”, students had the opportunity to visit a cork oak forest covering about 4700 ha, which is the habitat of diverse vegetation and countless animal species (wolves, woodpeckers, eagles, insects butterflies, etc). Another film “Ecological succession: Mata do Quadraçal” analysed potential impacts on ecosystems resulting from disturbance phenomena of natural or anthropogenic origin, and introduced the concepts of species extinction and conservation. Similar activities were carried out within the partnership: “Life on the rocky shoreline,” “life at the edge of the sea “ (Ireland), “Copou Park, Romania – Trees” (Romania) and “The diversity of animals that live in lake Grauzys” (Lithuania). The activities the project proposed can therefore be replicated in various natural contexts.

Rare species of birds will always make a fascinating subject as the chance to see them is often denied to most people. Students who have them nestle in a tree near their school may call themselves fortunate. So students took advantage of the presence of the long eared owls and observed them in their own habitat. They identified and defined some of their characteristics: habitat, appearance, food, nesting, behaviour. Although they are fairly common, the number of these birds fluctuates and it is difficult to determine due to habitat loss, competition for food with other species, their own secretive nature and tendency to move nomadically. As the populations of owls may be on the decline or even at risk of extinction they are protected by law in Romania. It goes without saying that an astronomy class takes place in a planetarium. The one in this example takes place in the Barlad Planetarium of Vasile Pârvan Museum Barlad, which is visited by a class of students from the National High School “Gheorghe Roșca Codreanu.” The teacher introduces the planetarium to her students who will begin their journey through the stars guided by the planetarium astronomer. The students observe the virtual sky of the planetarium, analyse and model a star map, make astronomical observations and learn how to read a map of the planets in different seasons. Their interest reaches its climax when they have to discover and learn about main sky constellations such as the Big Dipper, Orion or Cassiopeia. References to history and Greek mythology add to the quality of this visit. The lesson finishes with students having to recreate the constellations they have learned about in a very creative way.

Geological eras are better understood at a fossil site, such as the Repedea Hill natural reservation. Students become familiar with previous research conducted by Grigore Cobalcescu, which showed that 5-7 million years ago, in the Miocene geological period, the site where the Repedea hill is now was covered by the waters of the Sarmatian Sea, which occupied, from the West to the East, a huge area between today’s Vienna and the Tian Shan Mountains of Central Asia. Students engage in observations of the Repedea Hill reservation and the fossil site. Their visit is also a starting point for debates about the meaning of natural reserves and laws enforced to protect nature. Students also discuss the human impact on conservation areas as well as practical solutions meant to save our nature reserves.

Pollution is one of the most serious problems in the world, as the air, waters and soil are contaminated by harmful chemicals. Pollution has long-term and short-term health effects (eye, nose, and throat irritation, headaches, allergic reactions, lung cancer, brain damage, liver damage, kidney damage, heart disease, and respiratory diseases). Pollution also damages crops, animals, forests, and bodies of water. In addition, air pollution contributes to depleting the ozone layer. Human activities have been signalled as the major causes of air pollution, especially in the cities, where there is an increasing need for transportation and industries, resulting in the emission of harmful chemicals into the atmosphere. To reduce the problems of air pollution, people should be more aware of their actions in these areas. The teacher and students visited the park near the river Neris (Portugal). They discussed possible sources of water pollution and did experiments meant to determine the

level of water pollution. They found a very small amount of chloride, nitrate and ammonium ions in the Neris river. The water is soft and low acidic. It is not as polluted as they expected ([http://enature.pixel-online.org/learning\\_science\\_EL.php](http://enature.pixel-online.org/learning_science_EL.php)).

Another e-lesson takes place at the small village of Romeu, and starts with a challenge: “The population decided to make an intervention towards the preservation of the architectural heritage. The bells of the main church must be repaired and we need to know the height of the main façade for proper crane placement.” To accomplish this task, two approaches are demonstrated: the application of the triangles similarity theorem, using a cross-staff and a tape measure and the application of simple trigonometric concepts, using a quadrant and a tape measure. The films concentrate on the relation between natural aspects or phenomena and school subjects. Most of the films focus on biology: 43: Belgium (BE)/9, Portugal (PT)/12, Romania (RO)/7, Greece (GR)/7, Ireland (IE)/3, Lithuania (LT)/5, Italy (IT)-, followed by Geography-16: BE/2, PT/6, RO/3, GR/1, IE/-, LT/4, IT-, Physics-7: BE/-, PT/1, RO/4, GR/-, IE/-, LT/2, IT-, Mathematics-7: BE/-, PT/1, RO/4, GR/-, IE/-, LT/3, IT-and chemistry:4, BE/-, PT/1, RO/1, GR/-, IE/-, LT/2, IT-. There are 37 films where the topic was presented from two perspectives: BE/1, PT/1, RO/-, GR/7, IE/4, LT/7, IT/17. Some films involved more than two school subjects: 16: BE/-, PT/1, RO/-, GR/-, IE/7, LT-, IT/8. The natural phenomena were thus observed and studied in an almost holistic way.

### Teachers’

### testimonials

All teachers appreciated the quality of the resources: *‘The project offers a collection of high-value resources and strategies to promote scientific subjects teaching and learning. The set of e-lessons provide a demonstration of how it is possible to address educational needs taking full advantage of the nature’s potential: offering places where to carry out scholar activities, and achieve significant results; nature offers a wide range of interesting topics that capture students’ attention.’*

Teachers were of the opinion that the innovative method is successful because it follows the natural course of learning from concrete to abstract, from nature to science. *‘I think the videos speak volumes about students’ interest in such e-lessons from nature. Their involvement and engagement in the lesson is visible (thanks to new technology) no matter its stage (experiment, outside trip, teacher’s explanations). Probably because its steps follow the natural course and are put to good use: first they stir interest and questions, stimulate intellect, then encourage exploration and answers, quench thirst and instill love of research and of learning.’* Teachers noticed students’ interest in the process, their involvement and engagement in the lesson: *‘The project provides useful sources of inspiration and insights to introduce innovative methodologies in schools and to facilitate an effective students’ involvement, increasing their motivation and field-specific skills and competences.’*

Teachers agreed that the project platform provides quality resources for teachers: *‘As a teacher of biology I got a lot of teaching tips from the films posted on the project platform. Starting from nature (as suggested by the project idea) seems to be the ideal and natural way of introducing the topic to students; this will prepare them for more abstract explanations.’ ‘I have been fascinating by the resources offered by this project. I teach history and I am very interested to teach my subject in an integrated system. This web site gave me access to a Database of local areas relevant for the study of scientific subjects and I could get ideas about how I could better illustrate to my students facts about wars and battles. I am often working with my colleague who teaches geography classes and the site has shown me how to better cooperate in this partnership.’*

Teachers also highlighted the role of nature in the lesson as the location for lessons and as resource: *‘The set of E-lessons provide a demonstration of how it is possible to address educational needs taking full advantage of the nature’s potential: offering places where to carry out scholar activities, instead of the traditional school environment, and achieve equally significant results; nature offering a wide range of interesting topics that capture students’ attention, and that can be used to approach traditional school subjects in innovative ways; nature to bring teachers and students closer, and to involve students in cooperative educational activities.’*

Teachers also appreciated students’ involvement in film-making: *‘An important element was that students used multiple resources while searching for information and that their research was applicable for school curricular activities. They took part in e-films on collected materials and made presentations. I think it was great for them to participate in this project as they connected better and learned that their joint actions are of major importance in maintaining the environment as it is or even improve it.’*

Teachers agreed that the project suggests interesting topics highlighting problems they face such as pollution:

*'This project united students from different classes to explore nature, the environment of our Botanical Garden in Iasi as they did the research work on the bird population in this place. They also found out about natural protected sites in our area and the need to respect the legislation in use and even reinforce it. Pollution was another important matter that was debated and how they can decrease their own input in this phenomena.'*

Teachers were of the opinion that the project provides them with excellent teaching tips they can apply to their classes: *'The project E-Learning from Nature project has a very generous goal for the teachers who teach sciences and who want to increase the motivation of their students in the subject taught. What I noticed as a direct consequence is the fact that it has stimulated my students' proactive approach to learning a scientific subjects, such a physics. I have to say that I have been using the environment around to teach various topics but due to the fact that this project requires a lot of attention to nature I have been focusing on liaising more my teaching to natural phenomena has greatly contributed to innovating my teaching methodologies.'*

This project was of big significance for the students that took part in it, explaining, in a very relaxed and practical approach nature and the human body and how they interact. The plants and their needs, how we can help their development and also what to do to protect house plants was a lesson that my young students were very interested in and participated with glee. Having learning activities outside, in direct contact with nature, is vital for helping students appreciate their first hand experiences. Teaching older students to make connections regarding their body and the environment that surrounds us in a non-traditional way was really a challenge for the teachers. Explanations about physics phenomena as well as about the importance of chemical compounds and how they interact and the use of modern technologies like robots were successful with the students. Also, for the teachers, the online platform acts as new teaching material, helping us develop our teaching process." ([http://enature.pixel-online.org/learning\\_science\\_EL.php](http://enature.pixel-online.org/learning_science_EL.php))

### **Conclusions**

Bridging gaps between science and other subjects and particularly connecting science with nature is an innovative approach. The method will undoubtedly increase students' motivation by projecting abstract learning against a concrete context. Needless to say, if applied, it will facilitate the comprehension and study of science for several reasons: it makes use of state-of-the-art technology in the classroom; the materials created address all learning styles; teachers' main tool is students' innate curiosity which is continuously challenged; it instills love of learning through direct engagement with the environment. The project's methodology turns the learning process into an exciting experience of discovery, which reveals and explains what happens around us.

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