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ENHANCING LEARNING EFFICIENCY THROUGH THE 'E-LEARNING FROM NATURE' PROJECT

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***Abstract**: The article is a study based on the E-Learning from Nature project (2015-1-IT02-KA201-015133), which is funded by the European Commission with a view to promoting a proactive students' approach to scientific subjects learning by encouraging science teachers' use of innovative online teaching methodologies in their everyday practice. The objectives, activities and outputs of the project draw on the present challenging European context characterised by the unprecedented advance of technology and, paradoxically, students' underachievement in basic skills as far as scientific issues are concerned. The article examines the project's main objectives focusing mainly on improving students' low performance in scientific subjects, motivating them to learn science and, therefore, consolidating student knowledge of science subjects. The project supports teaching methodologies based on real life case scenarios and makes use of new technologies to promote scientific knowledge, which will definitely enhance students' involvement in the learning process. The underlying principle of the project is to promote solid cooperation among educational agents across European countries in order to create a comprehensive data base for teaching science in schools. The article also looks into the main outputs of the project: Online data base: a collection of information sheets, direct sources (photos, videos, drawings etc. available in digital format) about the flora, the fauna, the natural elements and any other human intervention of scientific interest in a specific environmental area; E-lessons: small video lessons aimed at identifying the connection between the above mentioned natural elements and school scientific curricular activities as well as the related basic skills to be acquired.*

***Keywords:** e-learning; science; new technologies; education; teaching-learning.*

I. CHAPTER I THE EUROPEAN CONTEXT AND THE E-LEARNING FROM NATURE PROJECT (OBJECTIVES, TARGET GROUPS, OUTPUTS)

Europe is facing a paradox: in spite of the remarkable advance of science and technology high school students are not interested in science, as illustrated by their low scores in Pissa tests [1]. The Strategic Framework for European Cooperation in Education and Training states that 'by 2020 the share of 15-year-olds with insufficient abilities in reading, mathematics and science should be less than 15 %' [1] and urges schools to stimulate students' motivation and interest in science. The E-learning from nature project is in line with this document highlighting the need for innovative teaching and learning approaches related to science.

The main objectives of the project are deeply rooted in the need to increase students' low achievement in scientific subjects, and motivate them to study science [2]. The direct target groups of the E-learning from Nature project are: Science and English teachers in secondary schools (students aged 14 to 19) as well as secondary school students. The project main outputs are [2]:

- "a collection of information sheets, direct sources (photos, videos, drawings etc. available in digital format) about the flora, the fauna, the natural elements and any other human intervention of scientific interest in a specific environmental area;
- related small lessons aiming at identifying the connection between the above mentioned natural elements and school scientific curricular activities and the related basic skills to be acquired;
- the guide for science teachers which details innovative methods to enhance students' motivation towards the study of scientific subjects and improve their basic skills in science".

II. THE PROJECT'S METHODOLOGY

The project promotes a few strategies that will enable teachers to motivate students to enjoy science by highlighting the relevance that science has in our students' lives. One essential way of stirring students' curiosity and engaging them is by connecting science to nature, where natural elements are important resources in the teaching and learning process. This is done gradually from students' observing and examining what is familiar, simple and known around them to their exploring scientific phenomena. Based on students' innate curiosity, the complex process becomes an interesting journey of knowledge supported by hands-on experiments and programmes as well as technology. The project makes use of a wide range of materials, which take into consideration students' different learning styles (pictures, diagrams, hand-outs, drawings, maps or videos, or practical hands-on experiments) [3].

III. E-LEARNING FROM NATURE PROJECT (GEOGRAPHICAL AREAS AND E-LESSONS)

The e-lessons are based on interesting natural sites existing in each partner country. Parks, gardens, nature reserves, lakes, mountains or hills are starting points in discussions about the history, flora or fauna of the place. Information from in/direct sources, photos, videos, or drawings have been collected, scanned and uploaded on the project site with a view to providing useful material to those interested. Teachers have used the collected materials to create e-lessons (small video lessons) highlighting the connection between the above mentioned natural elements and school scientific activities.

For example, the history of one's native city becomes more exciting if it is related to a mysterious village which is within easy reach from the city and whose culture dates back to a Neolithic–Eneolithic archaeological culture (6000 to 3500 BC): the Cucuteni culture. Little is known about this culture apart from the fact that it covered a large area and its populations built the largest settlements in Neolithic Europe, some of which contained as many as 1,600 structures. Archaeologists called it Cucuteni culture after the name of the village near Iasi where, in 1884, they discovered the first relics of this culture: ceramics. The information about the Cucuteni culture is accompanied by photographs presenting the Cucuteni village, ancient tombs dating from 4th- 3rd centuries BC, pottery, which is the most valuable heritage from the people of those times. Historians say that more than 6000

years ago a prosperous civilisation inhabited an area of more than 350.000 square kilometers, over what is nowadays the south-east of Transylvania and north-east of Vallachia, stretching across the entire Moldavia and Basarabia, and even western Ukraine.

Once students get familiar with the village, its surroundings (the Gosan hill, which used to be called "the Hill of the Kings") and its sights, they are shown a video which introduces them to the Cucuteni Archaeological Site and the history and the culture of the most valuable pottery heritage of Romania – the Cucuteni culture [2].

IV. E-LEARNING FROM NATURE PROJECT (GEOGRAPHICAL AREAS AND E-LESSONS)

The guide is easy to use and provides teachers with hands-on suggestions on how to: adapt new methods and tools to their changing school context for their students' benefit (increased motivation and better performance); promote problem-based and real life scenarios to enable students to improve their basic science skills; implement innovative interactive and proactive ICT-based approaches to stimulate students' involvement in their learning process; promote a learner- centred approach to science teaching and learning [3].

The guide is organised in four modules:

- teaching scientific subjects through problem based and real life case scenarios;
- enhancing students' scientific basic skills through their active involvement in the learning process;
- effective use of new technologies to promote scientific knowledge;
- transnational cooperation to promote scientific knowledge in school education [3].

4.1 Module1: teaching scientific subjects through problem based and real life case scenarios

Module 1 on teaching scientific subjects through problem based and real life case scenarios provides teachers with practical advice and case studies on how to enhance students' motivation to learn science by engaging them in research-action experiments. The chapter presents an overview of the main non-traditional methods: CLIL, task based and cooperative learning, advice on classroom management as well as new ways of communication which teachers can use to improve their rapport with their students. The chapter also gives useful details on how to start and do research by collecting, analysing and understanding information supporting them with best practice examples.

The following learning theories are considered to be very efficient in teaching [5]:

1. Active learning/ Learn by Doing (discovery learning, problem-based learning, experiential learning, and inquiry-based instruction).

2. Teaching to multiple learning modalities, where teachers take advantage of all learning styles, and use them in teaching and learning.

3. Teaching to multiple intelligences: the science teacher should design the curriculum so as to address as much intelligence as possible.

4. Metacognition: Teaching students to reflect on their thinking, which maxims learning.

5. Developing higher order reasoning (analysis, synthesis and/or evaluation).

6. Constructivism: students actively construct or build new ideas and concepts based upon prior knowledge and new information.

The chapter also identifies the main characteristics of teaching science effectively, where the lesson:

- has a strong component of practical experiences
- is responsive to students' cultures and prior experiences
- keeps science relevant and makes clear its relevance to students' lives
- aligns science concepts with the nature of science
- builds skills for lifelong learning
- develops students' literacy and numeracy skills
- uses technology as a tool to promote student learning
- uses assessment to promote student learning

- requires teachers to reflect critically on the teaching–learning relationship (ako), using the teaching as inquiry cycle [4].

4.2 Module 2: enhancing students' scientific basic skills through their active involvement in the learning process

Module 2 provides teachers with advice on and samples of how to plan and implement new teaching methods in order to engage students in the learning process by exchanging knowledge at national and international level. The chapter highlights the role that teamwork and its relationships, cooperation and collaboration, have in the learning process. Module 2 is also focused on the effective use of new technologies to promote scientific knowledge by giving insights into the main hardware tools: computers, interactive boards, mobile devices and software tools used in schools: virtual maps, social media, moodle, word press etc. The chapter presents new methodologies and technologies used in science education, meant to enhance students' motivation to learn science. The materials attempt to identify what is effective teaching in science and highlight the main learning theories which can be used (Flipped Classrooms, Social Media in the Classroom, Mobile Learning, Cloud Computing, MOOCs, Wearable Technology etc).

One subchapter deals with the gamification of education, which can help students be more motivated and engaged. Enthusiastic teachers have started using game-based learning techniques in their classrooms, which provides online learning opportunities for students who prefer a game-like experience.

Gamification has become popular and is one of the most talked about trends. Gamification can be an incentive to stimulate learning as it intensifies the student's experience by introducing a high degree of interactivity and practice [5].

4.3 Module 3: effective use of new technologies to promote scientific knowledge

Module 3 focuses on innovation in science teaching and learning. It also highlights the main obstacles and challenges in science education. Our world is facing an unprecedented development of science and technology. The influence of science and technology on our lives will undoubtedly continue to increase in the next years. All aspects of life in modern society have been touched by scientific and technological knowledge and skills, which have invaded the workplace and the public sphere as well as the private sphere and our leisure time. Scientific and technological knowledge and skills have become crucial for most of our actions and decisions. Meaningful and independent participation in modern society assumes scientific and technological knowledge and skills. However, the increasing significance of science and technology is not accompanied by a growth in students' interest in these subjects, as educational statistics relating to subject choice in school or enrolment in tertiary education show. On the contrary, in many countries, recruitment to scientific and technological studies is falling. Also, in many countries, there is a growing gender gap in the choice of scientific and technological subjects at both school and tertiary level. 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). The chapter examines the obstacles and challenges science education is confronted with, be they within the classroom, across the school system, or in the larger social arena; it also provides readers with a wide range of suggestions to choose from [4].

The European Commission has repeatedly underlined that given the unprecedented deveolpment of science and technology science education should be an essential component of the learning process. In order for European citizens to fully integrate into society they need to acquire the necessary knowledge of and about science. Therefore, education policies and systems should [6]:

- "ensure that science is an essential component of compulsory education for all students;
- support schools, teachers, teacher educators and students of all ages to adopt an inquiry approach to science education as part of the core framework of science education for all;
- address socio-economic, gender and cultural inequalities in order to widen access and provide everyone with the opportunities to pursue excellence in learning and learning outcomes;
- create mechanisms to foster individual reflection and empowerment."

Science education should balance requirements of theoretical knowledge and practical skills related to science in order to motivate students to learn. Basic understanding of science is considered a necessary skill for every European citizen.

4.4 Module 4: transnational cooperation to promote scientific knowledge in school education

Module 4 centres on transnational cooperation to promote scientific knowledge in school education. It promotes the use of virtual cooperation tools used to develop cooperative initiatives among schools. In addition, it also presents EU policy in this department. European policy is focused on education and training as a sector meant to play a critical role under its new Agenda. Member States should make the necessary investment in all education and training systems in order to improve their effectiveness and efficiency in raising the skills and competences of the workforce, which will allow them to meet the needs of an increasingly digital economy in the context of technological, environmental and demographic change [2].

Education and training can benefit from the introduction of innovative pedagogical practices and didactic materials. The materials in this chapter highlight not only the European Commission's funding opportunities (Erasmus+ and Europe 2020) but also other opportunities (Twinning, European school net, School education gateway, European shared treasure, Festival della Scienza) meant to increase teachers'cooperation and competences and strategies for the digitisation of education. The demand for digital competences is on the increase as societies are becoming increasingly digital. Education and training must address this need, which requires investment in infrastructure, organisational change, digital devices and digital competences of teachers, trainers and educators, as well as the creation of digital (and open) educational resources. European policies should facilitate learning mobility at all levels.

This module analyses national policies and issues that they focus on promoting scientific culture, knowledge and research among students; improving students' understanding of what science is used for; consolidating the teaching of science at school and increasing recruitment to mathematics, science and technology fields [2].

The module also presents the way science teaching is organised in schools round Europe. In most European countries, science as a school subject debuts as one general subject with an integrated programme, which includes elements of all its branches. Teaching science is split afterwards in secondary school into the separate subjects of biology, chemistry and physics.

The chapter also gives insights into several programmes and initiatives aiming at improving science teachers' skills and promoting existing practices in the initial education of science and mathematics teachers across Europe (school partnerships with science-related organisations, days/ events/ festivals promoting science, local/ national/international projects).

Last but not least, this last module provides the reader with successful stories about making science accessible and attractive to students: the European Projects, which have worked on issues related to information and communication technologies in school education, environmental and science education. European Projects have tackled issues related to information and communication technologies in school education, environmental and science education. The projects cover a wide range of topics. They have involved many different actors in the field of school education: teacher training institutes, universities and research centres, schools, local communities, associations, and sometimes also companies. Many projects have developed web sites. They have also developed initial or in-service teacher training courses, which have enabled student teachers and experienced teachers from different countries to improve their teaching skills in specific areas [2].

European projects on science suggest new techniques which can make science more appealing to students. They create communities of teachers and students who work together. They identify challenges and find solutions to problems. This subchapter provides the reader with successful stories about projects related to science, which have been created by teachers and which can be a source of ideas for other teachers [2].

V. CONCLUSIONS

It is imperative that science education should become more responsive to the needs of our society and develop positive attitudes to science. Teachers, researchers and other actors should be equipped with the necessary knowledge, competences and motivation in order to participate actively in the educational process, meant to stir students' innate curiosity and make the best of their cognitive resources [6].

The E-learning from nature project promotes an innovative approach, which connects science to other subjects and particularly to nature, thus providing students with a concrete familiar context. This facilitates their comprehension of otherwise difficult concepts and stimulates learning by appealing to their curiosity. The project follows the recommendations made by the European Commission which state that science should be taught in context, highlighting the application of scientific achievements to daily life [3]. The project encourages all learning styles and makes use of state-of-the-art technology in the classroom. In order for teachers to incorporate technology effectively into the classroom, the project provides teachers not only with valuable information about current trends in this area but also with tips on how to use them.

The innovative approach turns the learning process into an exciting experience of discovery, which reveals and explains what happens around us. Learning has a purpose and everything that students learn makes up a larger picture: students realize that knowledge is made up of connected and interrelated pieces that help them with the understanding of the world.

Reference Text and Citations

[1] http://eacea.ec.europa.eu/education/eurydice/documents/thematic_reports/133en.pdf (10January2017)

[2] http://enature.pixel-online.org/ (20January 2017)

[3] Anca Cristina Colibaba, Irina Gheorghiu, Stefan Colibaba, Rodica Gardikiotis, E-nature Project: an Effective Way of Enhancing Students' Motivation, New perspective in science education Conference, Florence, 2017

[4] David D. Thornburg, Five Challenges in Science Education, http://www.tcse-k12.org/pages/science.pdf (2December2016)

[5] E-Learning Industry, 5 Killer Examples Of Gamified eLearning, https://elearningindustry.com/5-killer-examples-gamified-elearning (15 December 2016)

[6] European Commission, SCIENCE EDUCATION for Responsible Citizenship, http://ec.europa.eu/research/swafs/pdf/pub_science_education/KI-NA-26-893-EN-N.pdf , 2015, (15 January, 2017)