DISCOVER PROJECT

Developing Resources for Science Education and Outreach

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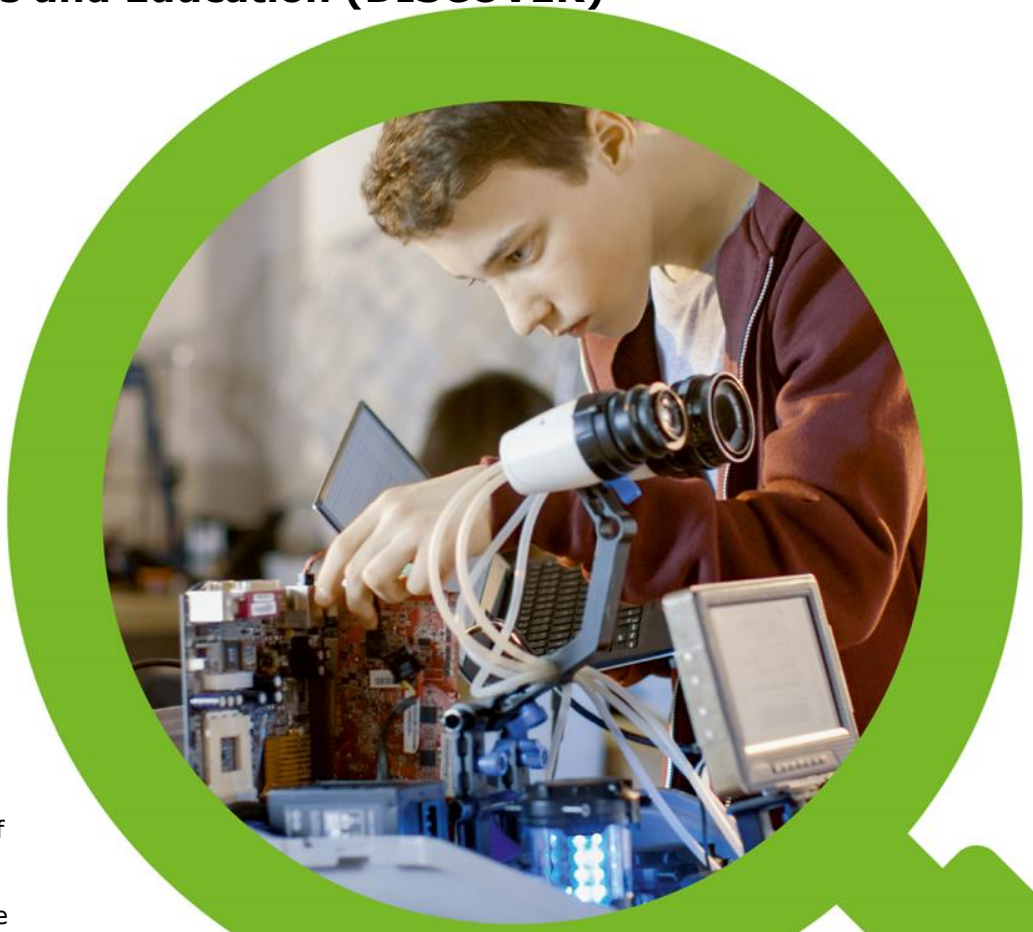
Developing Innovative Science Outreach for Vocational Education to Encourage STEM Careers and Education (DISCOVER)

Information Bulletin

Issue No.1



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Dear Reader,

This is the first e-bulletin of the DISCOVER project. Our project seeks to facilitate the design and delivery of science education at secondary school level. In a series of e-bulletins we will present the progress of our work and the resources for science education that we develop.

Europe needs – and in the foreseeable future will continue to need – a labour force that is skilled and knowledgeable in Science, Technology, Engineering and Mathematics (STEM). A STEM-skilled society is crucial for the growth of a competitive industry and for the ability of Europe to cope with pressing societal challenges such as health and demographic change, climate change, food security, border security, clean energy, etc.

A look at the situation in Europe suggests that under-achievement in STEM subjects in many countries remains above the Europe 2020 education target of 15%. Yet this is not a uniform result. Students' performance in STEM subjects and their motivation to invest efforts and time in pursuing a STEM career are determined by a complex set of educational, institutional, cultural, gender-related and social factors. Yet a student's socio-economic status is still the most influential determinant of level of achievement in science. There are significant differences among students' achievement in STEM across different schools in the same country, which suggests that for some students the school system does not deliver in terms of science education. Often there are limited opportunities to take science courses in some tracks, streams or schools.

Society is looking up to both schools and other stakeholders to find solutions to address the failure of the school system to provide good scientific training and to arouse scientific curiosity among young people. Some possible solutions relate to changes in teacher training or in the compulsory curricula. This project, however, is interested in a different approach: facilitating and improving extracurricular educational activities carefully targeted at promoting and communicating science among high school students. The efforts of the DISCOVER partner organizations are geared in this direction. We hope that our work will raise awareness of the responsibilities of different stakeholders to create conditions for effective and inspiring science training and will motivate and equip educators to design, implement and scale science education opportunities for Europe's young people.

Yours Sincerely,

The DISCOVER Project Team

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OUR OBJECTIVES

The DISCOVER project will develop teaching resources for extra-curricular science education at high-school level. It seeks to promote collaboration between secondary education and universities by providing resources that can be used or remixed in the implementation of science outreach activities. DISCOVER will focus on the areas of Robotics, Mechatronics, Physical Computing and the synergic combination between Art and Science.

Project results will be useful for educators at upper secondary education level (teachers, trainers in non-formal learning programs), secondary education students, and universities and research organizations seeking to enhance their impact on skills development at regional level. Future users will be able to use the developed resources directly to organize their own training or to modify and re-design them to suit their particular training needs.

While the project targets mainly secondary vocational schools, its results would also be applicable to general secondary schools.

Project activities are scheduled to be implemented between October 2017 and September 2019.

OUR OUTPUTS

1. Compendium of good practices in science outreach for secondary vocational education

The Compendium will feature in-depth analysis of selected good practices for science outreach. It will be complemented by a framework for institutional self-evaluation against basic benchmarking criteria. It would thus facilitate monitoring and capacity building in both universities and secondary schools, and in the longer run would encourage modernization of institutional strategies in the areas of science outreach and science education.

2. Resource Pack for Science Outreach for Secondary Vocational Schools

The Resource Pack will include concepts, lesson plans, activity organization and delivery plans for 10 types of science outreach activities, focused on a concrete scientific topic. The materials will be designed so that they could be replicated with or without modification by universities or secondary schools that wish to develop new opportunities for extracurricular science education.

3. Extracurricular training program in Mechatronics and Robotics for secondary vocational education

- ✓ Practice oriented training resources on fundamentals of Design, Robotics, Mechatronics and Programming
- ✓ Designs, training resources and guidelines for hands-on cross-disciplinary activities (Lab Sessions), including exercises, challenges, end-of-training competition

4. Extracurricular training modules in Programming for secondary vocational education

- ✓ Training module in fundamentals of Scratch, App Inventor and digital story creation, suitable for students without strong proficiency in Science, Technology, Engineering and Mathematics
- ✓ Training module in fundamentals of Python and Physical Computing, suitable for students with strong proficiency in Science, Technology, Engineering and Mathematics

The modules will include resources for concept training, as well as learning designs for hands-on activities.

OUR ACTIVITIES

1. Project Kick-off Meeting

The project kick-off meeting was hosted by European Center for Quality in Sofia on November 27th, 2017. It was focused on kick-starting collaboration, planning and fine-tuning upcoming project activities, developing quality control mechanism, and clarifying financial and implementation rules.

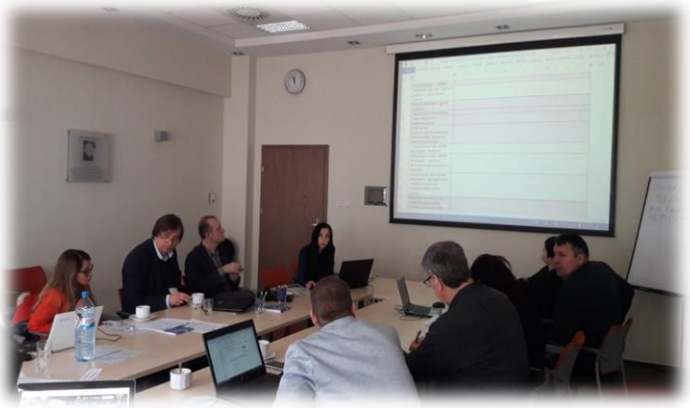
During a collaborative workshop, the consortium agreed on a common template for good practices of science outreach and discussed criteria for the good practices in order to ensure that research findings will be useful and relevant to a variety of stakeholders.

OUR ACTIVITIES

2. Second project meeting

The project's second meeting was hosted by PIAP in Warsaw on March 28th – 29th, 2018. It was focused on the joint development of supporting materials for the design and delivery of science education (DISCOVER Output 2).

During a collaborative workshop, the partnership planned 5 Route of Science classes and 5 Master Classes on a variety of topics, namely:



- ✓ ABB Robot Programming
- ✓ Smart Cities Platform
- ✓ Industrial Robotics
- ✓ Python targeting game development
- ✓ Arduino Programming and building of embedded system
- ✓ Blockchain Computing
- ✓ Graphical programming
- ✓ Creating, Building and Programming android application for mobile robots
- ✓ Robots in industry
- ✓ What is science and what scientists do

SOME HIGHLIGHTS FROM THE DISCOVER GOOD PRACTICES OF SCIENCE OUTREACH

1. Linking Science and Creativity – providing a platform for supporting and showcasing individual students' creativity projects that utilize new technologies

Organizing at local level a Science & Creativity festival, with elements of a contest, focused on students' individual creativity projects

Case study: Annual Students Digital Creativity Festival in Greece

2. Developing students' programming skills by using popular and accessible open source technologies

Organizing an online-based contest for student Programming projects (games, animations, etc.) using accessible and free programing platforms such as Scratch, App Inventor, Blockly, Android App Inventor, Alice, Stencyl, Gamefroot, Pocket Code, Hopscotch

Case study: Annual National Scratch Game Development Contest in Greece

3. Training teachers in game development, with the intent to encourage them to introduce game development in the classroom

Organizing training workshops on game development or Game Jam sessions for science teachers. The training could focus on game authoring using various domain-specific or visual programming languages, and could utilize various technologies and platforms

Case study: Training science teachers to design location-based games for STEM learning and teaching at Coventry University and University of Nottingham, UK

4. Training teachers in programming so that they can transfer this knowledge to students in extracurricular Code Clubs

Organizing teacher training (online or through presence workshops) in programming, and multiplying the impact of this training by involving teachers in the organization of local Code Clubs for students at local level, preferably hosted in local schools. In the Code Clubs, students receive training in the same programming language as the teachers, preferably also by getting involved in hands-on activities.

Case study: Training Informatics teachers in programming, followed by Code Club practice for their students - Greece

5. Organizing school-hosted Science Clubs for students to structure and galvanize student participation in STEM events and collaborations

This is a teacher-led good practice of creating extra-curricular science training for students in Clubs hosted within schools. The core of the good practice is the provision of systematic science education in the Clubs, while also searching and taking advantage of opportunities (as they arise) to arrange the participation of the students in collaborations and contests. The good practice can be applied to STEM education focused on a variety of subjects such as programming, educational robotics, STEM, STEAM (Science-Technology-Engineering-Art-Maths) and ESTEAM (Entrepreneurship-Science-Technology-Engineering-Art-Maths

Case study: Coding Club "GreekCodersK12" at 7th Public Junior High school of Athens, Greece

6. University lecturers organize outreach educational activities (presentations and hands-on learning activities) at secondary schools

This is a university-led good practice whereby university faculty reaches out to secondary education to impart knowledge in an attractive field of science (deepening or widening knowledge in this area provided in school), present results from scientific research and introduce secondary school students to technologies and equipment that are not readily available in a school lab.

Case study: Lessons with demonstrations organized by lecturers from Technical University - Gabrovo at vocational high schools – Bulgaria

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WHAT IMPACT WE SEEK TO ACHIEVE WITH THIS PROJECT

- Increased student motivation to pursue a science-related career or study science
- Introduced innovations in extra-curricular, co-curricular and curricular science education
- Improved quantity and quality of science outreach activities and non-formal science education for learners in secondary vocational education, and stronger engagement and co-creation in such activities by a variety of actors, including university students and industry
- Strengthened capacity for university-school partnerships in the vocational education sector and for science outreach and communication on the part of universities

Partners:

Technical University – Gabrovo, Bulgaria www.tugab.bg
@: tgnenov@gmail.com

ECQ
European Center for Quality, Bulgaria www.ecq-bg.com
@: gdimitrova@ecq-bg.com

John Atanasoff Vocational High School of Electronics – Stara Zagora, Bulgaria www.pgeja-sz.com
@: pgesz@abv.bg

Università degli Studi Guglielmo Marconi
Marconi University, Italy www.unimarconi.it
@: g.serino@unimarconi.it

Technical University of Crete
Technical University of Crete, Greece www.tuc.gr
@: nektar@ced.tuc.gr

Δ.Δ.Ε. ΧΑΝΙΩΝ
Directorate of Secondary Education, Chania, Greece http://dide.chan.sch.gr
@: europrogchan@dide.chan.sch.gr

PIAP
Industrial Research Institute for Automation and Measurements (PIAP), Poland www.piap.pl
@: piap@piap.pl

Technical University of Kosice, Slovakia www.tuke.sk
@: jozef.varga.2@tuke.sk

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