

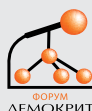


making science real

MAke science Real in sCHools

Recommendations from MARCH Network

January 2017



jungvornweg



UGDYMO
PLÉTOTÉS
CENTRAS



AGÊNCIA NACIONAL
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#MARCHscience

www.sciencemarch.eu



The MARCH (Make Science Real in Schools) consortium consists of 9 partners from 7 European countries and it brings together key players in the field of science education, science communication and relevant policies.

MARCH Consortium:

- ▶ British Council, United Kingdom
- ▶ British Science Association, United Kingdom
- ▶ Forum Democrit, Bulgaria
- ▶ Jungvornweg, Germany
- ▶ Scico, Greece
- ▶ Educational Radio-Television Directorate, Greek Ministry of Education, Greece
- ▶ Education Development Centre, Lithuania
- ▶ Ciência Viva, Portugal
- ▶ Centre for Science and Art Promotion, Serbia

MARCH OVERVIEW

MARCH network specific **aims and objectives** are summarised below:

- ▶ Provide an overview of Science Education in secondary schools through scoping and comparative analysis and promote the development of needs analysis
- ▶ Assist in the networking and content support of projects and networks that are thematically related and funded by the EU Life Long Learning programme
- ▶ Promote the implementation of innovative methodologies, insights and best practices in science education that allow dynamic interaction between teachers, young people, researchers and other experts in science education and science communication

These objectives have been achieved through:

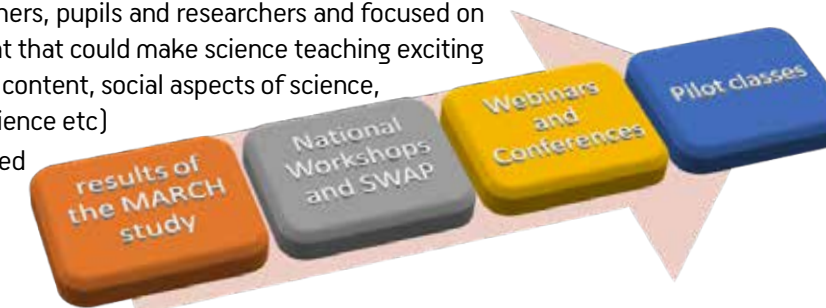
- ▶ The development of an online learning environment/forum for discussion and reflection on science education in secondary schools
- ▶ The production of a set of methodologies, best practises and tools that promote students' active participation and can be used by teachers in secondary schools so as to make science more attractive for young people
- ▶ The development (via the online platform) of a strong dynamic virtual community of teachers, students, scientists, science communicators, NGOs, cultural organisations with a broad interest in effective science education in secondary schools
- ▶ The production of a set of recommendations to policy makers on how to benchmark and mainstream innovative methodologies for science education in schools across Europe.

MARCH methodology:

- ▶ Involved the **active contribution of young people in the actual learning process** (peer learning, content created by pupils, mentoring schemes etc) so as to tackle low achievement in science (cf. ET2020 benchmarks).
- ▶ Highlighted the **relationship** between the **technical skills and knowledge** gained through science education and **future employment opportunities** so as to tackle motivation issues in pursuing a career in science.
- ▶ Emphasized the relevance and **applicability of science to everyday life** so as to promote science education as a key enabler for active, responsible citizenship.

Key project modules:

- ▶ **Initial scoping** - collection of best practices through desk research and interviews in partner countries, and through involvement of students in the whole process
- ▶ **'Innovation Swap Workshops'** presenting in each participating country and in a practical hands-on way, innovative practices from different countries - All partners in the project selected three practices to implement on a pilot basis. The workshops brought together teachers, pupils and researchers and focused on methodologies and educational content that could make science teaching exciting and attractive to young people (digital content, social aspects of science, researchers as role models, arts and science etc)
- ▶ **An extensive range of pilots** of selected practices in partner countries and **competitions** in order **to promote innovation in classrooms**.



“SCIENCE IS AN ENTITLEMENT AND RIGHT OF ALL CHILDREN
WHETHER THEY END-UP IN SCIENCE CAREERS OR NOT”,
PARTICIPANT, MARCH 3RD INTERNATIONAL CONFERENCE



LEARNING OUTSIDE THE CLASSROOM



HANDS-ON ACTIVITIES



USING ICT



INTERACTING WITH RESEARCHERS



MIXING SCIENCE AND ARTS

EDUCATIONAL CHALLENGES ADDRESSED BY MARCH NETWORK AND RECOMMENDED ACTIONS

MARCH seeks to address a number of educational challenges that are linked to students' perception on science and existing science education pedagogies in schools.

challenge I : Lack of effective educational methods

School students attending science classes can benefit greatly from participation in student-directed, open-ended scientific inquiry projects. Teaching methods, especially in the science subjects, still follow traditional methodologies and syllabuses, without taking into account neither the advancement of scientific research, nor the information environment young children are exposed to currently. The gap between education and research is still a major challenge in most economies. On the other hand, active students' participation in decision-making has become a "leitmotiv" across educational systems, although it has not affected the way science is taught at school.

Learning has a changing nature. Schools need to improve science education in order to provide useful service to the society as well as to better prepare the school kids for their adult life, enabling them to become responsible community members and active citizens of their countries. The education has to be more focused on "hands-on" experience than theoretically-based as it used to be. An improved dialogue between policy-makers, teachers and students should be facilitated and the school programmes need to be adapted to today's reality as well as to technological and scientific developments.

Rethinking Science Education Curriculums and best practices in Science Education

Science Education courses/materials/activities should be organised around innovative learning methodologies:

- › Using new media
- › Connecting science and art
- › Interacting with researchers
- › Learning outside the classroom
- › Coding – Using robots
- › Using hands-on activities

Recommended characteristics of future Science Education curriculums

Inquiry based - Experiential - Collaborative - Active Learning

- › Provide more flexibility and opportunities for innovative approaches and out of school activities
- › Better promote interdisciplinary approach in STEM education
- › Better direct students to the real scientific problems which have an impact on today's society
- › Encourage students to do their own independent analyses using observations and logic in order to resolve specific scientific problems
- › Allow teachers to easily respond to particular real-life scientific problems brought to the classroom by the students;

- › Regard students as the measure of teaching
- › Use specific and integrated project-based goals as part of learning
- › Connect science with future science-related careers and use relevant examples of role models in science and technology
- › Create opportunities for interaction and exchange of ideas among teachers, students and actual scientists and researchers

Give students a voice in the learning process

Top recommendations from students

- › The curriculum should focus more on industry, academia and student interests to prepare students for the real world
- › Students should be encouraged to develop their own manifesto for Science Education and therefore get their buy-in, build engagement and secure commitment
- › The curriculum should encourage more open book tests
- › School should encourage critical thinking and discourage memorising
- › Schools should forge links with other educational bodies so that resources are shared among everyone
- › Schools should integrate more project work into teaching with focus on creativity.
- › Government and NGOs should encourage more international exchanges so that everyone can learn from each other



"There are artists / writers / poets in residence - is it time for engineers or researchers in residence in schools?"

challenge II: A shortage of well-qualified science teachers capable of providing a positive experience may be influential in pupils' attitudes towards school science

Recent policy dialogues have highlighted the importance of understanding teachers' perspectives about science so that they can be properly supported. In addition, it is generally acknowledged that a paradigm shift in science pedagogy needs to be recognised and fostered; teachers are not science lecturers but should be seen as facilitators of learning and be supported as such.

Teachers play an integral and essential role in the process of providing innovative science education in their classroom. Current professional development schemes for teachers and other educators fail to address today's challenges.

Teachers could become the agents of change in their schools and contribute towards the cultivation of a supportive culture that rewards innovation, risk taking and 'thinking out of the box'.

Facilitating a new learning environment for teachers

It is important that policy makers understand **the importance of science education**:

- › Political support and detailed national strategies for adequate funding of science education and career development of teachers are needed. Policy-makers at all levels need to recognise STEM teaching as a driver for innovation and professional career development, particularly in fields with a shortage of highly qualified labour force such as engineering
- › More national measures and schemes should be envisaged to attract and retain talented science teachers; Professional education and training programs should be a priority at national level in order to ensure career development of science teachers.

Redesign professional development schemes for teachers in science education with emphasis on:

- › Encouraging closer interaction with students in learning planning
- › Actively involving researchers and experts from various disciplines in science classes and initiatives
- › Designing mentoring schemes between peers at national and international level
- › Creating "real" and "meaningful" connections between educators and other stakeholders such as NGOs and other partner organisations that have a shared mission of promoting STEM education.
- › Using Arts and Creativity in Science Education
- › Developing Critical Thinking

Create a culture of continuous learning and innovation:

- › Avoid the introduction of one-off initiatives and cultivate long-term projects that can have a tangible and measurable impact
- › Allow time for innovative ideas to be put in place and be monitored throughout the year
- › Give incentives for pilots and testing of new ideas

- › Create opportunities for teachers in various disciplines to work on the same projects
- › Offer flexibility and more opportunities for teachers to be involved in the development of science education projects
- › Reward extra-curriculum activities and 'thinking out of the box'
- › Encourage dialogue and two-way communication among teachers and policy makers/stakeholders to make sure their voice is heard and their considerations are taken into account
- › Make sure the schools' management creates an encouraging environment for teachers to be creative and apply new methodologies in their classroom

Make available or improve access to new tools and resources for Science Education in the classroom:

- › Educational web-sites and e-learning platforms;
- › ICT in classroom including smart phones and tablets with scientific software and applications for scientific simulations;
- › Equipment and consumables available for day-to-day experiments;
- › Online and remote laboratories;
- › Virtual tours (for example in CERN);
- › Use of social networks, blogs, etc

challenge III: Need for linking science educational content to 'real' life

"It is not about Science Education anymore - It is about Creativity and Innovation in the Classroom"

Key recommendation:

Informal science education techniques should become an important and compulsory part of every educational system. Science education agenda in all schools should provide students with more opportunities to:

- › apply "learning by doing" approaches;
- › learn through games and competitions;
- › be trained to recognise accurate information and cross-check sources, especially in the online environment;
- › perform their own independent analyses using observations and logic in order to solve specific scientific problems;
- › be engaged with the practical side of science in their everyday life;
- › be mentored and get first-hand knowledge by experienced researchers on specific topics of their interest;
- › be aware of what the problems in their local and global society are;
- › present their work and promote their experimental achievements by participating in science events and conferences organised by the school or relevant institutions;
- › visit open days in universities, research centres and industry.

More science workshops, festivals and other kinds of events involving scientists, researchers, teachers, and students need to be organised.

There is a need for specifically designed features of secondary school STEM education in order to better facilitate knowledge development of the links between science and everyday life and careers. This will help students to overcome potential speculative views on the value of science in the real world.

Public policies and public funded programs need to focus especially on creating incentives for common STEM related activities for family members, students and their teachers.

challenge IV : Need for a joint European approach

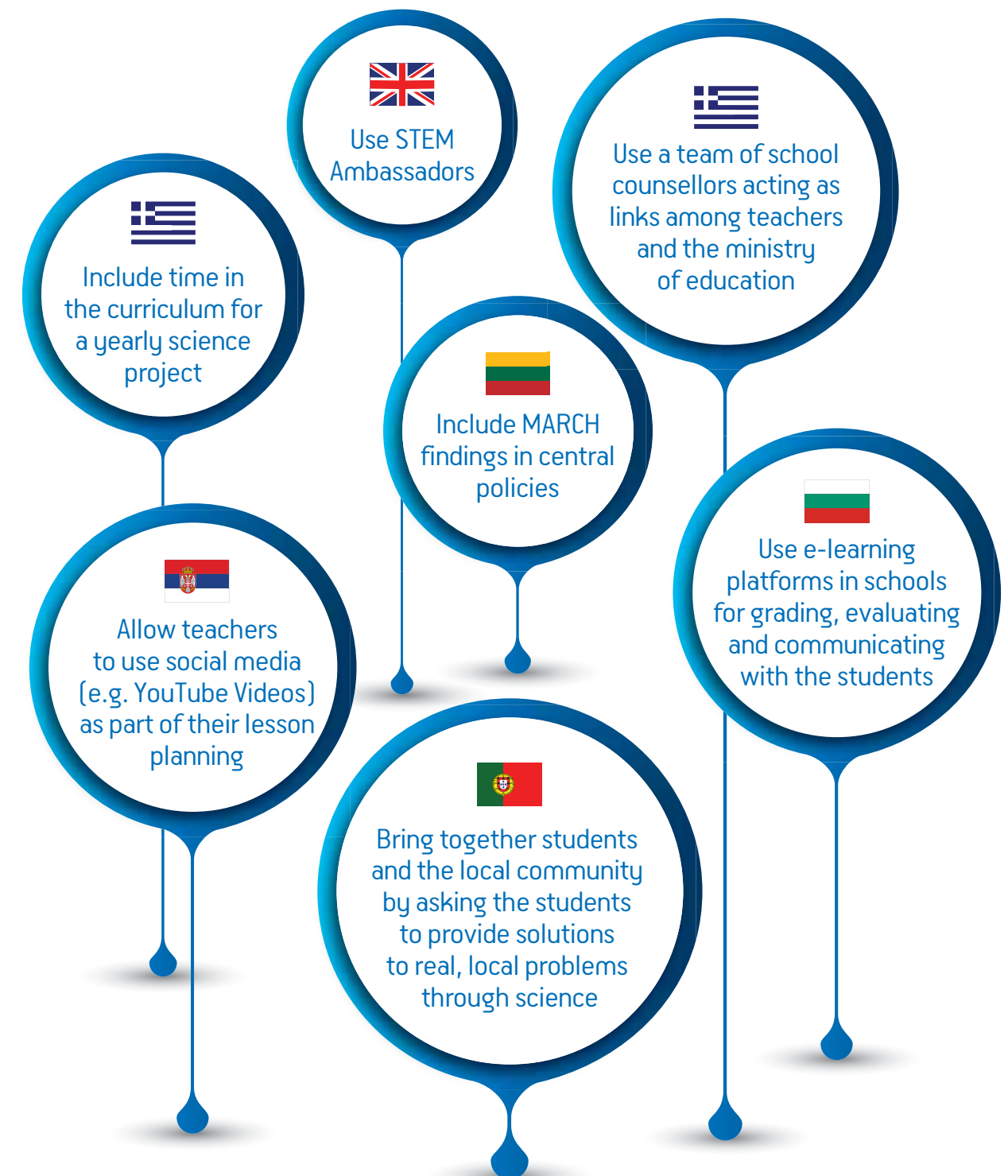
MARCH Network addressed this challenge through a unique blend of national and international activities and methods of engagement that brought together teachers, policy makers and students from all over Europe. By attending these events most participants, especially in the international conferences, felt that they gained new valuable insights on science education in Europe and became aware of innovative science education methods.

Learning from each-other

- ▶ More national and EU schemes for schools are needed in order to support the development of science education and networking
- ▶ European projects should offer more opportunities for teachers from different countries to share experiences and ideas on a more regular basis. Taking advantage of the existing technologies to facilitate communication will help in creating links as well as motivate them to stay in touch and work together.
- ▶ Engage educators, students and policy makers in international interactive sessions- learning from each other is hugely appreciated by all involved groups



SHARING GOOD PRACTICES FROM MARCH COUNTRIES: EXAMPLES



LOCAL WORKSHOPS



WWW.SCIENCEMARCH.EU