EUROPEAN COMMISSION
RESEARCH EXECUTIVE AGENCY

Spreading Excellence, Widening Participation, Science with and for Society

Science Education Cluster Event
14th November 2019
REPORT

INTRODUCTION

In order to allow science education projects funded under the Science with and for Society (SwafS) programme the opportunity to forge new collaborations, strengthen the science education community and provide input on shaping science education in Horizon Europe, the REA in collaboration with DG RTD organised a cluster event on 14 November 2019. DG EAC was closely involved in the planning to ensure synergies with their conference on 'Supporting Key Competences Development: Learning approaches and environments in school education' held during the same week.[1]

All SwafS science education projects were invited as well as the science communication projects given that communication was the subject matter of one of the workshops, resulting in 16 projects partaking in this cluster event.[2] In the spirit of co-creation, projects provided input to the agenda and project representatives moderated and reported on the discussions.

Ales Fiala, the Head of Unit of REA B5 (Spreading excellence and widening participation, Science with and for Society) opened the event and welcomed all participants.

Following an introduction to the policy context and a presentation by DG EAC on key competences development, the event centred around three workshops:

1. **THE POLICY CONTEXT OF SCIENCE EDUCATION**

2. **KEY COMPETENCES DEVELOPMENT: KEY POINTS OF RELEVANCE FOR SWAFS SCIENCE EDUCATION**

3. **WORKSHOP 1: PROMOTING COMMUNICATION AND DISSEMINATION OF SCIENCE EDUCATION PROJECTS**

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[1] https://www.eac-events.eu/ereg/newreg.php?eventid=200189265&

[2] See Annex for the list of projects

4. WORKSHOP 2 : ENHANCING SUSTAINABILITY AND IMPACT OF PROJECT FINDINGS AND OUTPUT DURING AND AFTER THE END OF THE PROJECT

5. WORKSHOP 3: SCIENCE EDUCATION IN HORIZON EUROPE

0. THE POLICY CONTEXT

Lia Karamali, Head of Unit, RTD-G2, presented the policy context.

This cluster event is well placed in terms of the broader interaction with stakeholders in the period of Horizon Europe preparation. Efforts are on-going to link project results to policy activities to ensure evidence-based policy-making. Policy feedback is necessary to feed into Work Programming drafting.

Under Horizon 2020, strategic activities such as the EU Contest for Young Scientists (EUCYS)[3], the Community of Science Education in Europe (Scientix)[4] and collaboration with European Schoolnet[5] as well as the science education portfolio represent a prominent proportion of the SwafS Work Programme, amounting to approximately 70 million Euro.

The new Commissioner Mariya Gabriel's portfolio covering both Education and Research is a strong signal for synergies between both domains.[6] To this end, DG RTD is already working closely with DG EAC. The big policy priorities are to identify synergies between research and education as well as brain circulation in terms of how we can attract talent in Europe which the German presidency prioritised in terms of revitalising the ERA.[7]

Horizon Europe preparations encompassed three rounds of consultations: July-October 2019 online consultation; September 2019 R&I Days; concluding with online consultation with umbrella organisations.

The policy drivers for the future are the education continuum and European universities transformation. The European Commission is working on establishing links between education and business for example in ensuring the right skills set for the future workforce. There is also a particular focus on universities to establish powerful networks in the global context and looking at how Horizon Europe can support these networks. The European Universities Initiative[8], for example is one of the current flagship

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[3] https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/eucys_en

[4] http://www.scientix.eu/home

[5] http://www.eun.org/

[6] The EU Presidencies 2020 priorities are the brain circulation where challenges are the monitoring of mobility and the talents' attraction towards the EU, the revitalisation of ERA, and the jobs and skilling up challenges. This programme represents a magnificent window of opportunity that appears for all stakeholders with the new European Parliament and the new Commission to work together and launch meaningful policy actions.

[7] https://data.consilium.europa.eu/doc/document/ST-5512-2020-INIT/en/pdf

[8] https://ec.europa.eu/education/education-in-the-eu/european-education-area/european-universities-initiative_en

initiatives of the EU's ambitions to build a European Education Area.[9] Establishing a European Education Area will enable young people to benefit from the best available education and training and seek employment across Europe.

Opportunities offered by actions such as this cluster event whereby stakeholders come together and identify gaps and ways to exploit project results based on their experience are essential input for the European Commission's development of future Work Programmes.

1. KEY COMPETENCES DEVELOPMENT: KEY POINTS OF RELEVANCE FOR SWAFS SCIENCE EDUCATION[10]

Vladimir Garkov Policy Officer, from DG EAC B2 Schools and Multilingualism made a presentation on Key Competences Development.

Competences includes the combination of knowledge, skills and attitudes, while the eight key competences[11] (literacy; multilingualism; numerical, scientific and engineering skills; digital and technology-based competences; interpersonal skills, and the ability to adopt new competences; active citizenship; entrepreneurship and cultural awareness and expression) are required for all individuals to function successfully in society.

The main challenges in STEM[12] education are to develop STEM key competences for all citizens, increase the achievement level and interest in STEM, address the shortage of STEM teachers and prepare a competent STEM workforce.

Policy support for STEM education development at the EU level include realising the European Education Area, drafting a renewed EU Agenda for Higher Education, school development and excellent teaching with a focus on inclusion of the underachievers and finally, the key competences framework.

Findings of the OECD PISA[13] show that, despite perceptions, regular browsing of the internet for schoolwork at school does not help students to achieve higher levels of reading literacy. Moreover, traditional teacher-directed instruction is linked to higher levels of academic achievement in science than innovative enquiry-based teaching, for the majority of pupils. However, generally students using enquiry-based methods tend to be more interested and motivated to learn science. Both examples illustrate how non-evidence based perceptions notably, that nowadays people could tend to consider the use

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[9] https://ec.europa.eu/education/education-in-the-eu/european-education-area_en

[10] This DG EAC contribution is based on the conclusions of the Seminar on "key competences development: learning approaches and environments in school education", which took place in Brussels on 12-13 November 2019.

[11] https://ec.europa.eu/education/education-in-the-eu/council-recommendation-on-key-competences-for-lifelong-learning_en

[12] Science, Technology, Engineering and Mathematics

[13] PISA is the OECD's Programme for International Student Assessment. PISA measures 15-year-olds' ability to use their reading, mathematics and science knowledge and skills to meet real-life challenges. https://www.oecd.org/pisa/

of internet and innovative teaching the optimal learning tools, could lead to false advice to policy makers. It shows that traditional methods work and while the intention is not to abandon enquiry-based learning, the findings need further investigation.

Some examples of actions to make the teaching of science relevant for consideration by policy-makers are:

- STE(A)M[14] approach integrating the arts;
- sustainability and scaling-up of good practices through Erasmus+ ;
- cooperation between schools, governments, and industry (e.g. EU STEM coalition, national STEM platforms);
- support for STEM teachers (e.g. Scientix);
- partnerships between schools (e.g. in the eTwinning Platform) ;
- involvement of the local community and inclusiveness measures based on the pupils socio-economic status issues;
- call for proposals for the establishment of an EU network of centres for cross-disciplinary teaching;
- dissemination of good practices;
- linking science education with citizenship key competence;
- development of key competence and assessment framework on science and maths education;
- using the Personal, Social, and Learning to Learn competence as a vehicle for the development of STEM and the other competences

Regarding STEAM, the idea of combining apparently unrelated elements is one of the winning strategies for the entire schooling approach, aiming at transforming the school into a hub for each local community while encompassing citizen science principles. Education for sustainable development is intended to be science-based, multidisciplinary, action-oriented and ensuring a drive for social and personal change.

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14 STEAM (Science, Technology, Engineering, Arts and Mathematics)

2. WORKSHOP 1: PROMOTING COMMUNICATION AND DISSEMINATION OF SCIENCE EDUCATION PROJECTS

The communication and dissemination strategies and outcomes of science education projects are vital for promoting a culture of scientific thinking, inspiring students of all ages to aspire to careers in STEM, sharing expertise and disseminating "good practices" at all levels and within the educational actors' "communities of practice".

The first workshop addressed the challenges of finding ways to better communicate the outcomes and align the goals of science education projects with the values, needs and expectations of the educational society.

The discussion revolved around three questions:

1. Main issues related to the dissemination and communication of science education projects;
2. How can science education projects better disseminate and communicate (concrete examples with a view to identifying best practices)?
3. How can the science communication field help in overcoming obstacles?

The workshop commenced with a presentation by Dr Agueda Gras-Velazquez from Scientix[15]. Scientix, focused on communication and dissemination with approximately 500 ambassadors, has been running for the past 9 years. Numerous science education projects called upon the support of Scientix to promote their activities in various ways. Scientix can support projects by helping to co-organise events or provide support in papers e.g. a recent paper on how to bring citizen science into education was cited. The Scientix platform has over 8,000 resources, 600 projects and 2,900 online resources.

Scientix is organising the 2020 STEM Discovery Campaign, an initiative dedicated to celebrating careers and studies in the fields of STEM.

A.   Issues related to the dissemination and communication of science education projects and solutions proposed for better dissemination and communication

Concerning the first two questions, the difficulties that science education projects faced internally (within the consortium - usually easily solved) or externally (with external stakeholders) are grouped into the following five categories and solutions to the identified issues are proposed:

    a)   Partners involvement in dissemination and communication
    b)   New concepts related to future educational policies
    c)   Language & adaptation of resources
    d)   Reaching stakeholders at a National or EU level
    e)   Enhance dissemination by teachers

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[15] Scientix is the community for science education in Europe, that promotes and supports a Europe-wide collaboration among STEM teachers, education researchers, policy-makers and other STEM education professionals.

a) Partners involvement in dissemination and communication

Issues:

At the proposal writing stage, not all partners contributed to the dissemination and communication aspects and subsequently, few partners were involved during the project, which limited the possibility to reach out to all planned stakeholders.

Communication is not a priority for many project partners with their main focus being on project activities and when the time came to communicate the results, it was difficult to establish and run an effective plan.

Solutions:

All consortium members should be involved from the proposal writing stage in the planned dissemination of results and communication of project activities, which should include a clear plan outlining activities for all partners together with the planned resources and updated regularly as the project progresses.

When a project commences, a campaign on the projects' objectives with a carefully reflected message targeting stakeholders should be disseminated via the media and social networks.

b) New concepts related to future educational policies

Issues:

It is difficult to communicate to national policy-makers the outcomes of projects that introduce new concepts promoted by the EU, for example Responsible Research and Innovation or Open Schooling. National educational policy-makers are hesitant in adopting successful results or further promoting a project when they are not familiar with the underlying concepts.

Solutions:

DG RTD strongly encourages reliance on Scientix/European Schoolnet to inform national representatives and/or ministries of education about reports issued by the EU on science education and the latest trends or areas of focus.

Furthermore, coordinators of projects integrating new concepts are encouraged to disseminate the new concept early on to raise awareness at the national level.

c) Language & adaptation of resources

Issues:

Language is a barrier as many teachers are not fluent in English. Even though project materials are usually translated in the required languages, there is an issue with the evaluation sheets being completed in various languages, as the answers need to be subsequently translated into English. The same holds true for other project material. Moreover, engaging stakeholders in a more general concept on which a project is based (e.g. RRI) without having translated materials becomes an obstacle in dissemination.

Solutions:

A solution could be to exploit the Scientix offering which foresees translating educational material at no additional cost. In addition, proposals can foresee a budget for translation that Scientix cannot cover.

A pre-requisite stipulated in the topic/call should be that promotional/educational materials be made available in more than one language since the main target groups for science education are teachers, children or young people who often cannot readily use material that is only available in English.

d) Reaching stakeholders at a National or EU level

Issues:

It is difficult to disseminate the outcomes of a project to policy-makers (at national or European level) and educational authorities (at national level) although it is easier to reach the press at local than at the European level and regarding the latter, CORDIS[16] is not an effective channel.

Solutions:

Europe-wide joint initiatives are highly effective in allowing a project to reach the press/media in international contexts. Several projects working on the same topic/concept could consider preparing joint recommendations, reports, articles and/or final conferences in order to increase the impact of the outcomes of their projects and ensure a wider audience. An example is the CREATIONS conference that involved a number of EU projects working on the area of "creating conditions for deeper learning" in various educational environments and through different subjects to run workshops e.g. CREATIONS through Arts, and DG CNECT funded projects: Stories of Tomorrow through storytelling, iMuSciCA through Music and eCraft2Learn through creative technologies.[17]

Linking an educational authority to the project provides direct access to policy-makers in the field of education.

A project could also consider running a communication campaign in conventional media with the goal of not only reaching citizens but also influencing the political agenda via the media (public policies).

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[16] The Community Research and Development Information Service (CORDIS) is the European Commission's primary source of results from the projects funded by the EU's framework programmes for research and innovation (FP1 to Horizon 2020). CORDIS has a public repository with all project information held by the European Commission such as project factsheets, participants, reports, deliverables and links to open-access publications: https://cordis.europa.eu/en

[17] http://creations2018.ea.gr/, https://www.openschools.eu/, http://www.storiesoftomorrow.eu/, http://www.imuscica.eu/, https://project.ecraft2learn.eu/

e) Enhance dissemination by teachers

Issues:

Teachers are primarily focused on implementing an activity in the classroom rather than partaking in the dissemination effort. In general, they are interested in the materials and tools offered to them rather than the projects' outcomes. Students also do not perceive a role for themselves in communicating the project beyond their school.

Solutions:

Projects should directly interact with teachers and provide them with guidelines to build their skills on how to communicate in an effective manner to selected target groups in an effort to boost interest in science.

Schools should run dissemination activities that raise awareness on possible job opportunities for young generations in the field of STEM.

Schools should encourage students' families' involvement in public events to increase their awareness of the importance of STEM disciplines (in particular STEM labour market options and STEM enabled careers).

B. Learnings from science communication

Concerning the third main question addressed in the workshop on how the science communication field can help in overcoming obstacles in the dissemination and communication of science education projects, the science communication field can play an important role in boosting each project and disseminating its outcomes. In order to optimise this, it is crucial to step back to realise how and when science communication meets and supports science education. Possible contributions as indicated below are linked to the:

- **Development of the education methodology**: This includes co-designing with the key stakeholders (both educators and recipients, i.e. teachers, scientists, students, etc.) the education methodology to adopt for science education;

- **Communication and dissemination of findings**: Guidelines from experts in the field should be used to effectively communicate and disseminate the project findings (e.g. include instructions on how to communicate through social media). It is essential to raise the awareness of the science education community about the importance of involving **professional science communicators** in the process.

Based on actions tested in science education projects, the following eight **good practices** and **approaches** are identified:

1) It is vital to raise awareness on the importance of involving professional figures for the communication of the project findings (e.g. science communicators). At the proposal stage, consider collaborating with **professional communicators on social media** either as a partner or foresee budget for a third party to deliver this service. In an ideal scenario, the project should dedicate one person to social media. A lower-

cost solution would be to involve journalism and audio-visual communication internship students that can co-plan the dissemination of the project's results.

2) Make use of **socially empowered portals** bringing together schools from different European countries notably those that have experience with the open schooling culture. Such schools will already be involved in activities promoting the use of open content and open pedagogies and establishing open cooperation schemes with local stakeholders, industries and research organisations. Offer a unique platform for science education projects to test or practice their outcomes and share them with a strong community of practitioners. Support schools to share their science projects on the platform and build synergies around them.

3) **Map the existing platforms** (e.g. CORDIS, OSOS, SySTEM2020, School Education Gateway[18]) to identify the kind of data/information/resources/evaluation they provide. This exercise should firstly assess the opportunities that these platforms offer and secondly, assess how projects can collaborate and exploit their communication and dissemination channels. Given the current high number of science education projects (with new projects commencing every year), the task of identifying good practices becomes increasingly challenging. Therefore, the **creation of European platforms** that bring together good-practices on science education, expand the network of stakeholders and provide dissemination channels are important for communicating the outcomes of projects.

4) Analyse the **needs of stakeholders** and act accordingly (e.g. social media for public, press/media for politicians) using different dissemination approaches. Plan interactive face-to-face dissemination events (demonstration, discussions and practical hands on activities during the events).

5) Make use of **special services** such as the common dissemination booster[19] or of (existing) science shops in the partner institutes as dissemination spots.

6) In terms of media/publications, projects should pro-actively contact **academic publishers** to try to introduce the outcomes of educational science projects in specialised books or chapters. Also, design **original and creative videos** for social networks on the project results. Use all conventional dissemination strategies such as the website, logo, social networks, and other policies provided in the communication and dissemination plans.

7) Try to connect with **other funding schemes** such as Erasmus+ that support teacher training and organise summer schools to implement and disseminate the projects' approach and results.

8) **Enhanced networking among coordinators of H2020 projects** (especially those funded under the same call) may lead to an exchange of dissemination channels maximising communication with the broader educational community. Networking may include collaborative activities among projects such as the co-organisation of a

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[18] https://cordis.europa.eu/, https://www.openschools.eu/, https://system2020.education/, https://www.schooleducationgateway.eu/

[19] https://cdbservices.eu/

(closing) conference or a summer school. These initiatives should be encouraged, supported and promoted by the EC, as they become multiplier events that increase their impact (e.g. joint publications).

WORKSHOP 2: ENHANCING SUSTAINABILITY AND IMPACT OF PROJECT FINDINGS AND OUTPUT DURING AND AFTER THE END OF THE PROJECT

The workshop consisted of two parts: firstly, participants identified issues that hinder the sustainability of project outputs and reduce their impact during and beyond the end of the project and subsequently, participants formed discussion groups to provide suggestions on how to overcome the issues raised.

The topics discussed can be grouped in the following categories:

a)   Information
b)   Communication
c)   Collaboration and competition
d)   Framework and resources
e)   Focal points
f)   Volatility

a) Information

Issues:

Lack of information on other projects was the issue most frequently cited. Participants conveyed the need to receive information on:

- Other science education projects funded under the same topic;

- Other relevant projects funded under SwafS;

- National or regional projects with potential synergies to improve project impact.

Solutions:

The REA should communicate to each project the names of other projects funded under the same or similar topics including publically available contact details. In addition, the European Commission should provide information about related topics funded under other programmes (e.g. Erasmus+).

Developing a "Horizon science education service" in line with those developed for Copernicus services[20] offering a service for the science education community including a data store, bulletin, best practices, networking platform etc.).

Project factsheets could help spread information on findings from previous projects, reducing the tendency to "reinvent the wheel".

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[20] https://www.copernicus.eu/en/services

b) Communication

Issues:

Information alone will not produce notable results unless communicated properly with a view to encouraging collaboration. There are two aspects of communication to address:

- Communication between projects in terms of establishing direct contact with other projects is the first obstacle to overcome;
- Communication about projects, their content and output notably the promotion of important results that is not sufficiently fostered due to lack of a common identity and goals for projects of a particular 'cluster'.

Solutions:

Science communication could enhance the impact achieved by university researchers on educational projects. It would be important to present project findings and output either on a project-by-project basis or in the form of a **cluster of projects** in events such as European Week of Regions and Cities, the Education Conference, the EUROCITIES annual assembly, or any other relevant event.

Language is a barrier! It is particularly important to provide output (notably those intended for educators or parents) in different languages. Translated material for teachers or parents will increase impact.

Centralised communication support with tailored strategies to address the right audience and promote important outcomes is necessary using all modern channels (e.g. social media). Such a support service could offer for example SwafS branding identity, visual promotional material targeting policy-makers (fact sheets) and citizens (infographics). Impact measurement should consider outreach activities that address different communities, taking into account quantitative and qualitative terms as well as the mid and long-term perspectives.

c) Collaboration

Issues:

Exchange of information and proper communication actions should lead to collaboration between projects. However, projects generally fail to plan joint activities and each project works towards realising its own activities in accordance with its own tight schedule.

Furthermore, there is limited collaboration at programme level between Horizon 2020 and Erasmus+, either in terms of information exchange or at the level of project design and implementation. Organisations tend to participate in either programme and often platforms in the different EU programmes are different.

Solutions:

Establish **synergies between projects** in order to promote alliances among projects from the beginning, not only among projects funded in the same topic, to go further and pursue open cooperation between projects in different areas.

Organise **cluster reviews or common events** of similar projects.

Projects could join forces with other projects and organise joint conferences and other events such as workshops or common training sessions, for example, summer schools for teachers. Projects could also produce a white paper (common papers can be important).

Competitors in future topics may be an issue impeding collaboration between projects, as the competition inevitably emerges between organisations that submit a proposal together for a given SwafS topic call. Consequently, collaboration may occur either at a personal level or through existing networks.

d) Legal Framework and Resources

Issues:

Projects are obliged to implement activities as foreseen in the Grant Agreement Description of Action. Consequently, there is limited scope to collaborate on joint activities with other projects if not foreseen from the outset. Furthermore, when project outputs have been produced, it is late in the process to change them as a result of influences from another project. Although submitted deliverables can be re-opened (within the same reporting period), the question is whether projects wish to re-work an already submitted deliverable to account for influences from another project.

Lack of resources can affect possible actions to promote or exploit project outputs and seek synergies beyond the end of the project. Participants were not aware of any available scheme they could use to sustain project outputs, apart from obvious ways of submitting a new proposal. In such cases, however, the proposal has to be tailored to the requirements of the topic to which it will be submitted and therefore this may not be an optimal solution for exploiting project outputs.

Solutions:

The Work Programme should make collaboration activities mandatory in the project work-plan and at the proposal stage, resources should already be allocated to producing deliverables in a clustered manner, for example to include cooperation with other projects as a work-package in the work-plan.

It would be useful to enable changes in the work-plan and in resource allocation to accommodate synergies. Once selected for funding, projects should be encouraged by the EU to liaise with other projects to assess whether any changes in their work-plan are required in order to address common issues, such as a "common" deliverable (for example a roadmap).

e) Focal Points

Issues:

The lack of focal points for members of the SwafS community was also raised systematically as there is no official digital/physical venue where (past, current and future) project members could "meet" and exchange research issues, new ideas, techniques and results, important outputs, and so on.

Solutions:

A virtual space for the SwafS community could help a lot. Platforms are necessary (e.g. Scientix), especially as community motivators and repositories of project outcomes. Scientix ambassadors can facilitate reaching a wider audience. Alternatively, the School Education Gateway Platform[21] run by the EC can provide visibility to projects, while also providing metrics for using materials.

Science education projects should make resources available within the Scientix repository, which helps in sustaining the visibility of educational materials. Common standards (e.g. in ICT or in quality) should be considered.

Creating a **centralised repository for outputs** is another solution, once implemented and well recognised, such a platform could be of great benefit for both teachers and projects. To face the difficulty of dispersing results, the EC should present a platform for all project outputs to be showcased (filtered and categorised) with "step by step" guidance. Most teachers do not have time to read several research papers in search of an innovative method to use in the classroom, so the centralisation of information could facilitate exploitation of results, ensure sustainability and ultimately result in greater impact. The use of this common repository, managed by the EC for all science education results, should be mandatory for all project participants. Participants can of course in parallel use other relevant repositories (national, subject-based, institution-based ones).

f) Volatility

Issues:

The research community is highly dynamic and once a SwafS project ends, researchers move on to work on a different project. One of the main implications is that knowledge of the sector acquired by a researcher is lost once they move to a project in another sector or researchers new to the SwafS community need to learn from scratch issues that the SwafS community is dealing with and the instruments used although new researchers bring new perspectives and fresh knowledge.

Solutions:

In order to face this issue, we could sustain the community, perhaps by using a database of CVs from which researchers can be picked for new projects, organising common workshops with old and new projects, create a forum for the community and so on. Such initiatives would greatly enhance information exchange, collaboration and synergies between projects, while they would help the community tackle the "brain drain" issue and speed-up the learning process for new researchers. Projects must be based on excellence and it is important to include scientists in the projects both from the different academic subjects to ensure the quality of the material e.g. biologists, philosophers, engineers etc. and from pedagogical backgrounds to ensure the quality of the methods and formats.

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[21] https://www.schooleducationgateway.eu/en/pub/index.htm

WORKSHOP 3: SCIENCE EDUCATION IN HORIZON EUROPE

During this workshop, participants were organised around two main themes: 1) identifying gaps and future needs of the science education community and 2) learning continuum and linking science education with business

1) Identifying gaps and future needs of the science education community

a) Connect formal and informal ways of learning

Very often informal settings provide more innovative pilot approaches as they are generally not framed by syllabi, technical limitations or time constraints and therefore can function as incubators of new contexts. Curricula are more inert as on average major curricula changes take place roughly every decade.

We need to coordinate efforts to specify if informal learning complements the classroom or succeeds where the classroom might have failed. Consideration should be given to the impact that can be achieved by science education outside schools and how this form of informal schooling might be accredited and whether there is a way of assessing the quality of the educational contents.

The adoption of inquiry methods for example needs significant modifications in the current curricula structures. It is crucial for EU services and upcoming calls to focus on this area and to work on the findings of previous large-scale projects in the field.

Informal and non-formal formats are important complementary aspects of formal education and should not substitute inadequate formal education. Future calls should consider the interaction of informal (and/or not formal education) with formal education.

b) Better define and integrate open schooling

Within the current calls, initial approaches are offered to "open up schools". As schools are complex institutions, changes need to evolve smoothly although it is essential that pilot schools show the potential when those other than teachers and students are the actors.

Open schooling should build on the notion of the science capital of students' families, in order to attract more students to science. In fact, as recently discovered, whilst science and technology are often attractive to young adolescents, this interest is not reflected in students' engagement with science at school, which is particularly true of girls who tend to be less interested in pursuing careers in physical sciences and engineering.

There are certainly more than a few ways to open up schools in a constructive way. Therefore, both bottom-up (OSOS is a reference for bottom up) and top-down initiatives are needed. Regarding the latter, clear definitions of open schooling in EU calls need to be foreseen.

An open school culture imports external ideas that challenge internal views and beliefs and, in turn, exports its students and their assets to the community it serves. Such an engaging environment makes a vital contribution to the community: student projects meet real needs in the community outside of school, they are presented publicly, and draw upon local expertise and experience. The school environment fosters learner independence and interdependence through collaboration, mentoring, and providing opportunities for learners to understand and interrogate their place in the world.

c) Learn from the different partner countries educational systems

Currently, there are 50+ educational systems within the Member States, each with their own strengths that may offer options to fertilise existing national systems.

d) Integrated framework for science education projects to optimise synergies

Initially the focus was on inquiry, and then it shifted to RRI and now to STEM or STEAM. The use of STEM and/or STEAM changes across calls that renders the follow-up of project results somewhat difficult. Furthermore, there is a request for STEM or STEAM activities while at the same time, there are no curricula or teachers dedicated to STEM per se.

The outcomes of the projects include frameworks, resources, methodologies, training materials, roadmaps, recommendations for different audiences: teachers, students, policy makers, researchers, so different groups with different interests. Publishing the outcomes of hundreds of projects on a portal is not sufficient and harvesting the outcomes of related projects needs to be optimised.

The EC through a systematic evaluation of the outcomes of projects should focus on the high achievers to design more focused activities that will help us move to a more effective and integrated plan focusing key stakeholders of such actions.

A more integrated structure and approach is needed and consideration given to a framework to build on previous initiatives. A systematic and methodological approach is needed for the design of future calls to avoid isolated efforts with little potential to expand.

e) New ways back to science : tackle anti-science attitudes

Science is not a favourite subject for many students. Introducing innovative, creative issues with good relations to everyday life might bring interest back.

Similar to the above new ways back to science reflections, everyday connections or new issues of great public visibility (such as barcoding or micro-plastic) might help decrease anti-science attitudes and raise awareness and interest.

f) Open towards citizen science

Citizen science is of increasing importance for science including the public generating data and raising levels of interest in science. In each citizen science project, a clear science education component should be integrated. Studies published examine the place of citizen science within education.

We have to take into account the ways educators will collaborate with members of the community that could be a means for democratising science. A solution could be to use open schooling as a vehicle to interconnect science education and citizen science.

g) **Improve project evaluation methods**

Assessment methods in many funded projects rely on ad-hoc instruments and lack basic psychometric minimal standards. This approach prevents the comparison of project outcomes within the same call. Furthermore, many projects struggle to show their added value and successful approach.

h) **Maintain 2-stage evaluation**

Success rates of calls are still quite low and a 2-stage evaluation model is appreciated preferably with the modification that constructive feedback is given to the successful stage-1 applicants. However, the duration of the evaluation process is too long: successful SwafS proposals start project eighteen months after the initial call deadline. Nonetheless, participants are in favour of maintaining the 2-stage process but speeding up the evaluation so that projects start earlier.

i) **Support science education across Horizon Europe projects**

Regarding the possibility of mainstreaming, as a complement to standalone science education calls, it is proposed that across the Horizon Europe programme, Coordination and Support Actions (CSA) could be funded to support a cluster of projects/similar topics/per theme in a specific field.

The CSA would be comprised of a consortium made up of science education, citizen science, science communicator's expertise, and every element that could support Horizon Europe projects implement SwafS related activities.

2) Learning continuum and linking science education with business

The suggestions for future calls in the frame of Horizon Europe refer essentially to three ways able to fill the gap with the business world:

a) Create a platform to connect science education with business
b) Make the business world a reality for children
c) Identify mutual benefits

a) **Create a platform to connect science education with business**

As linkages with business are still not usual, a platform offering the possibility for teachers to book the time of business professionals to come to school for example. Such a platform could also serve as a "stock exchange" to seek partnership options.

b) Make the business world a reality for children

Organise visits for school children to a local entity to see where something tangible/that they are familiar with is produced to understand how service operates. Another possibility is to invite parents of a particular profession to come to school and speak about their job.

c) Identify mutual benefits

For a small-scale coordination action, developing strong and effective links with business is challenging. Nevertheless, there are some cases that demonstrate the impact of such interventions. One example is the "STEMpowering Youth" initiative developed in the framework of the PATHWAY project[22], under the Erasmus+ Programme, which is adopted by the Vodafone Foundation as Generation Next initiative. The main idea is to support students to design projects solving local problems, mainly in rural areas.

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[22] The PATHWAY project, under the Erasmus+ Programme, aims at providing learners with a training programme, which meet their needs in the sector of social entrepreneurship. It also aims to raise awareness on the role social entrepreneurship can play in local development, fostering also be the establishment of links and cooperation between different stakeholders.

CONCLUSIONS

This first cluster event on science education has been fruitful in terms of both providing suggestions to the European Commission on promoting science education in Horizon Europe and facilitating networking among projects.

The suggestions made to the European Commission include the following:

- In accordance with the respective national competencies, existing EU platforms like Scientix should take a leading role not only in publishing new trends in science education but also in communicating at a national level new concepts and approaches promoted by the European Commission.

- The European Commission should encourage funded projects to proactively share their dissemination and communication strategies. The grant condition on additional dissemination obligations could be one means of encouraging this effort. As a complement, the European Commission should continue to organise cluster events to bring projects together to share ideas and outputs.

- The European Commission should design a roadmap for future calls in Horizon Europe based on an analysis of the current portfolio. The European Commission should continue to fund calls, addressing different aspects of science education including open schooling topics, offering schools the opportunity to act as innovation hubs in their local settings as efforts to integrate a change culture in school settings[23] has great potential to achieve deeper learning in STEM for all students.

- New calls should include a mechanism for policy feedback from the project to the European Commission, for example, the recent new practice of including a policy brief as a mandatory deliverable should be pursued.

- A "how-to" guide with common tips for ensuring project sustainability would be useful. The European Commission may wish to offer support beyond the end of the project to sustain momentum for particularly impactful actions, for example, school networks.

In conclusion, this first science education cluster meeting, highlighted the need to clarify for the research community the perspective of the European Commission on science education in Horizon Europe. The continuation of science education as a separate topic, as is currently the case in the SwafS Work programme, is essential in parallel to mainstreaming science education with the proper support structures in place for novice projects.

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[23] The idea here is to facilitate change of the organisational culture of schools, so that they become less rigid, less formal, more open, more encompassing (in terms of educational methodologies, subjects offered, inclusion etc.), better oriented to the needs of the society and the local settings, more supportive of citizen science.

Future calls should always encourage collaboration between science education and research in different scientific fields and in doing so encourage public engagement in science to empower EU citizens.

ANNEXES:

- Agenda
- Science education cluster event with participating projects

EUROPEAN COMMISSION
RESEARCH EXECUTIVE AGENCY

Spreading Excellence, Widening Participation, Science with and for Society

AGENDA

**SCIENCE EDUCATION CLUSTER MEETING
14 November 2019**

Covent Garden – Auditorium COV A2 6-31
Place Rogier 16, Sint-Joost-ten-Node, 1210 Brussels, Belgium

08:30	**REGISTRATION**
09:00	**WELCOME & SETTING THE SCENE** Ales Fiala – Head of Unit REA B5 Spreading excellence and Widening participation & Science with and for Society
09:15	**THE POLICY CONTEXT** Apostolia Karamali – Head of Unit RTD G2 Academic R&I and Research Organisations
09:30	**DG EAC SEMINAR ON "KEY COMPETENCES DEVELOPMENT: LEARNING APPROACHES AND ENVIRONMENTS IN SCHOOL EDUCATION" (12TH-13TH NOVEMBER)** **KEY POINTS OF RELEVANCE FOR SWAFS SCIENCE EDUCATION** Vladimir Garkov – Policy Officer DG EAC B2 Schools and Multilingualism
09:45	**1ST BRAINSTORMING WORKSHOP:** **PROMOTING COMMUNICATION AND DISSEMINATION OF SCIENCE EDUCATION PROJECTS (BEST PRACTICES; POTENTIAL INPUT FROM SCIENCE COMMUNICATION PROJECTS)** *First indication of themes to be discussed (can be enlarged during the workshop):* ➢ How can science education projects better disseminate and communicate (concrete examples with a view to identifying best practices) ➢ Lessons learned from science communication field *Introduction by Scientix:* Agueda Gras-Velazquez, Head of the Science Education Department , Scientix *Moderator:* Alessandra Fornetti (QUEST project) *Rapporteur:* Angelos Lazoudis (OSOS project) *Project officer:* Cristina Marcone

11:15	COFFEE BREAK
11:30	**2ND BRAINSTORMING WORKSHOP:** **ENHANCING SUSTAINABILITY AND IMPACT OF PROJECT FINDINGS AND OUTPUT DURING AND AFTER THE END OF THE PROJECT** *First indication of themes to be discussed (can be enlarged during the workshop):* ➢ Establishing synergies between projects during the course of implementation as well as following their conclusion: means and preconditions ➢ A platform / teaching and learning environment that could cover the needs the projects are facing (strengthen our community, forge new collaborations and provide support on shaping science education) = one-stop SwafS Educational Marketplace where European youth, parents, teachers, educators/researchers and the business society unite to complete the circle *Moderator:* Halldor Johannsson (EDU-ARCTIC project) *Rapporteur:* Achilles Kameas (UMI-Sci-Ed project) *Project officer:* Wolfgang Bode
12:45	**NETWORKING LUNCH**
14:15	**3RD BRAINSTORMING WORKSHOP:** **SCIENCE EDUCATION IN HORIZON EUROPE (IDENTIFYING GAPS AND NEEDS TO BE ADDRESSED, NEW EMERGING RESEARCH, METHODS, APPROACHES, AREAS ETC.)** ➢ Linking of different levels of science education notably with respect to cooperation between secondary and higher education ➢ Linking science education with business world ➢ Measures set-up to better educate young scientists ➢ Identifying gaps for future exploration (e.g. big data, STEAM pedagogy, communities of practice, inclusion of marginalized groups) ➢ Mainstreaming science education. Introduction: Karen Slavin – Policy Officer RTD G2 Academic R&I and Research Organisations *Moderator:* Karen Slavin *Rapporteur:* Franz Bogner (CREATIONS project)
15:30	**COFFEE BREAK**
15:45	**MAIN CONCLUSIONS FROM THE WORKSHOPS & OPEN DISCUSSION** *Chair:* Federica Roffi – Deputy Head of Unit REA B5 Spreading excellence and Widening participation & Science with and for Society 5 minute summary by rapporteur of each session (1 or 2 slides)
16:45	**CLOSE OF MEETING**

EUROPEAN COMMISSION
RESEARCH EXECUTIVE AGENCY

Spreading Excellence, Widening Participation, Science with and for Society

SCIENCE EDUCATION CLUSTER MEETING
14 NOVEMBER 2019

PARTICIPATING PROJECTS

CREATIONS
Developing an Engaging Science Classroom

https://cordis.europa.eu/project/rcn/198210/factsheet/en
www.creations-project.eu

Coordinator: University of Bayreuth

The CREATIONS coordination action aims to demonstrate innovative approaches and activities that involve teachers and students in Scientific Research through creative ways that are based on Art and focus on the development of effective links and synergies between schools and research infrastructures in order to spark young people's interest in science and in following scientific careers.

STIMEY
Science Technology Innovation Mathematics Engineering for the Young

https://cordis.europa.eu/project/rcn/203161/factsheet/en
www.stimey.eu

Coordinator: Universidad de Cádiz

STIMEY (Science, Technology, Innovation, Mathematics, Education for the Young) proposes an multi-level educational platform, designed and developed on the basis of a well-researched pedagogical framework, which aims to make STEM education more attractive to young people from age 10 to 18 years old. The socially motivational platform for emotional and educational engagement platform will combine: social media components and entrepreneurial tools (present), robotic artefacts (the future), radio (the past) to educate, engage and increase the youth's interest in STEM education and careers.

EDU-ARCTIC
Innovative educational program attracting young people to natural sciences and polar research

https://cordis.europa.eu/project/rcn/203165/factsheet/en
www.edu-arctic.eu

Coordinator: Instytut Geofizyki Polskiej Akademii Nauk

The general objective of the EDU-ARCTIC project is a cross-country adaptation of innovative practices in science education in Europe. EDU-ARCTIC will provide a custom-designed large-scale program to strengthen schools' science education. EDU-ARCTIC will use innovative online tools for interactive open-access available for everyone to link Arctic research and school education in Europe. The program is dedicated to young students in the age of 13 to 20 and their teachers.


STEM4youth
Promotion of STEM education by key scientific challenges and their impact on our life and career perspectives

https://cordis.europa.eu/project/rcn/203170/factsheet/en
www.stem4youth.eu

Coordinator: Politechnika Warsawska

STEM4you(th) seeks to produce a comprehensive, multidisciplinary series of courses presenting key STEM discipline challenges to support young people, primarily high school students aged 14-19, formal and informal education. The content will be organized around 7 STEM disciplines: Mathematics, Physics, Astronomy, Chemistry, Engineering and Medicine. For each discipline 7-9 challenges will be presented largely through their practical applications and their impact on our everyday life and work.
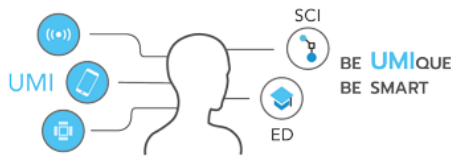
UMI-Sci-Ed

Exploiting Ubiquitous Computing, Mobile Computing and the Internet of Things to promote Science Education

https://cordis.europa.eu/project/rcn/203171/factsheet/en
www.umi-sci-ed.eu

Coordinator: Computer Technology Institute and Press Diophantus

The aim of the project is to investigate the introduction of Ubiquitous Computing, Mobile Computing and Internet of Things (UMI technologies) in education. By carefully exploiting state of the art technologies in order to design educational tools and activities, the project aims to offer novel educational services, implement innovative pedagogies and enhance students' and teachers' creativity, socialisation and scientific citizenship.

MARINE MAMMALS

Using marine mammals for making science education and science careers attractive for young people

https://cordis.europa.eu/project/rcn/203173/factsheet/en
www.marine-mammals.com

Coordinator: Christian-Albrechts-Universitaet zu Kiel

The Marine Mammals proposes to create a European consortium of education and research institutions, alongside small to medium enterprises, to promote STEM subjects and students' interest in science careers. Teacher trainings and summer schools will be carried out in close contact with scientists from different disciplines, to allow students to gain first hand insights into 'real' science as well as the profession of a scientist.

OSOS
Open Schools for Open Societies

https://cordis.europa.eu/project/rcn/210250/factsheet/en
www.openschools.eu

Coordinator: Ellinogermaniki Agogi Scholi Sanagea Savva AE

The OSOS coordination action aims to support a large number of European schools to implement Open Schooling approaches, facilitate the transformation of schools to innovative ecosystems acting as sites of science learning shared between leaders, teachers, students and the local community. They should share responsibility, authority, and all benefit through the increase of their communities' science capital and the development of responsible citizenship.

OSHub
Open Science Hub Network: Empowering Citizens through STEAM Education with Open Schooling

https://cordis.europa.eu/project/rcn/224141/factsheet/en

Coordinator : Universiteit Leiden

Open Science Hub Network is a European network of community space in which schools will be actively involved as agents for collaboration between civil society, enterprises, research institutes and community at large through Science, Technology, Engineering, Art and Mathematics (STEAM) learning. OSHub will engage communities, civil associations and families, in tackling local challenges using Inquiry-Based Science Education (IBSE) and Responsible Research and Innovation (RRI) concepts and principles.

PHERECLOS

Partnerships for pathways to Higher Education and science engagement in Regional Clusters of Open Schooling

https://cordis.europa.eu/project/rcn/224142/factsheet/en

Coordinator: Kinderburo Universitaet Wien GmbH

PHERECLOS builds upon the theory of science capital and the experience that Children's Universities (CUs) have made in the Third Mission of universities. With their engagement with children and young people, they became intermediaries between various actors in the educational and social landscape. The project will establish 6 "Local Education Clusters" (LECs) bringing together schools and further relevant actors in the education ecosystem of a particular pilot region, supported by a peer mentoring programme. The LECs will be incubators for enabling a dialogue between various parties and help to set up joint activities in education, which help to develop collaborative learning environments as experimental testbeds for schools. PHERECLOS will implement a digital ecosystem showcasing all LEC parties and labelling them as reliable and responsive actors and to produce real change in education

PULCHRA

Science in the City: Building Participatory Urban Learning Community Hubs through Research and Activation

https://cordis.europa.eu/project/rcn/224070/factsheet/en

Coordinator: Ethniko Kai Kapodistriako Panepistimio Athinon

The PULCHRA (Latin for *beautiful*) project will explore the open schooling concept in the theme "Cities as urban ecosystems", in view of creating new partnerships in local communities to foster science education for all citizens. Schools, in cooperation with other stakeholders, will become agent of community well-being, taken that the theme to be explored encompasses the natural environment, the built environment and the socio-economic environment in cities.

SEAS
Science Education for Action and Engagement towards Sustainability

https://cordis.europa.eu/project/rcn/224138/factsheet/en
www.seas.uio.no

Coordinator: Universitetet i Oslo

The main objective of the Science Education for Action and Engagement Towards Sustainability (SEAS) is to establish, coordinate and evaluate collaboration among six open schooling networks led by universities and science As part of these networks, and drawing on principles of inquiry-based science learning for transformative engagement, students in formal schools are given the opportunity to engage in addressing real-life, complex sustainability challenges that are identified and dealt with together with participants and stakeholders in the local community.

RRI in Higher Education curricula

HEIRRI
Higher Education Institutions and Responsible Research and Innovation

https://cordis.europa.eu/project/rcn/197446/factsheet/en
www.heirri.eu

Coordinator: Universidad Pompeu Fabra

The higher education institutions partners of HEIRRI will foster an alignment of research and innovation (R&I) with the needs, values and societal expectations. Also, different stakeholders involved and/or affected by R&I will participate in a debate and reflection process on RRI Learning through online and offline Forum actions. Results from the inventory will represent the basis for RRI Training programs and formative materials, offering the students knowledge and skills to develop viable solutions to specific problems related to R&I, integrating theory and practice.

CoM_n_Play-Science

Learning science the fun and creative way: coding, making, and play as vehicles for informal science learning in the 21st century

https://cordis.europa.eu/project/rcn/214432/factsheet/en
www.comnplayscience.eu

Coordinator : Norges Teknisk-Naturvitenskapelige Universitet

The CoM'n'Play-Science project aims to help Europe better understand the new ways in which informal science learning is taking place through various coding, making, and play activities that young Europeans are nowadays increasingly engaged with outside school and higher education science classrooms, beyond the formal boundaries of science education. The project investigates a wide range of loci and modes of this kind of informal science learning, including: a) learning occurring in the context of such activities intentionally organized to achieve informal science learning; b) informal science learning that occurs as a by-product of youngsters' various coding, making, and play activities that are not intentionally meant for science learning, and which may take place either in organized contexts or independently in everyday life.

SySTEM 2020

Connecting Science Learning Outside The Classroom

https://cordis.europa.eu/project/rcn/214917/factsheet/en
www.system2020.education

Coordinator: Trinity College Dublin

SySTEM 2020 will focus on science learning outside the classroom, mapping the field across Europe, evaluating a number of transdisciplinary programmes to design best principles for educators in this field, and also examining individual learning ecologies by piloting self-evaluation tools for learners which will document science learning outside of the classroom. This study will map practices in 19 EU countries, including in-depth studies in 8 of these countries, covering learners between 9 - 20 years from various backgrounds including those from geographically remote, socio-economically disadvantaged, minority and/or migrant communities.

QUEST
Quality and effectiveness in Science and Technology communication

https://cordis.europa.eu/project/rcn/219700/factsheet/en
www.questproject.eu

Coordinator: Venice International University

During the two-year project, researchers and experts from the QUEST consortium investigate science communication in three strands – journalism, social media and museums – through three focus areas: climate change, vaccines and artificial intelligence. The project takes stock of science communication today, defines quality criteria, and provides supporting tools for journalists, social media managers and museums facilitators. Ultimately, the goal is to offer citizens effective and reliable communication on scientific topics that generally have a significant impact on their daily lives, such as the three topics selected as focus areas.

CONCISE
Communication role on perception and beliefs of EU Citizens about Science

https://cordis.europa.eu/project/rcn/220369/factsheet/en
https://concise-h2020.eu/

Coordinator : Universitat de Valencia

CONCISE aims to generate a European-wide debate on science communication, involving a wide array of stakeholders, from media outlets to policy makers, from scientists to business companies, from science communicators to civil society organisations. CONCISE aims at providing qualitative knowledge through citizen consultation on the means/channels (media and social networks, life experience, relatives, religion, political ideology, educational system...), by which EU citizens acquire their science-related science knowledge, and how this knowledge influences their beliefs, opinions, and perceptions. For this purpose, CONCISE will explore the understanding of 500 citizens (representing the 500 million EU citizens), regarding four selected topics: vaccines, complementary and alternative medicine use (CAM), genetically modified organism (GMO), and climate change.

Bridging the Gap

Unit B5

Spreading Excellence, Widening Participation
Science with and for Society