

REACH OUT TOOLKIT

**Dissemination and exploitation of Science,
Technology, Engineering and Mathematics
Education projects in Europe**



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Executive summary

This Reach Out Toolkit is aimed at managers and coordinators of Science, Technology, Engineering and Maths (STEM) formal and informal education projects. It will help you awaken your stakeholders' interest in your STEM project results and facilitate their use. The main goals are to:

- ▶ Provide you with information about the targets of your STEM education project and allow you to look at your diffusion, dissemination and exploitation practices with new eyes.
- ▶ Identify obstacles which prevent you from achieving a successful dissemination and exploitation of your messages to stakeholders.
- ▶ Give you tools to create a multiplier effect when transferring and implementing results and eventually mainstreaming them into policies.
- ▶ Provide you with practical tips based on lessons learned and experience from teachers and other STEM education stakeholders.
- ▶ Highlight approaches which can federate existing initiatives and point to key European or national services that can act as relays for the results of science education projects.

Introduction

This Reach Out Toolkit will ensure STEM education projects results reach teachers and other STEM education stakeholders. It is intended for project managers and project coordinators who are running initiatives to improve learning and teaching of STEM in formal education (schools) and informal education (science centres, museums, fairs, events).

This is a practical guide based on the results of a survey and several discussion events with the main target groups active in STEM education carried out in the context of the DESIRE project. The objective is to help **project managers and project coordinators** to overcome the dissemination and exploitation challenges of formal and informal science education projects. The DESIRE project (<http://desire.eun.org/>) was run by European Schoolnet (EUN Partnership AISBL) in collaboration with INDIRE (Istituto Nazionale di Documentazione per l'Innovazione e la Ricerca Educativa), Universitat Autònoma de Barcelona, Danish Science Factory and Ecsite (The European Network of Science Centres and Museums).

From 2011 to 2013, STEM teachers, STEM education project managers, professionals working in informal education (science centres, museums, fairs and events) and policy makers were consulted on how new project results on STEM education can reach teachers and other stakeholders more efficiently.

The DESIRE team invited STEM education professionals to tell about their experience in accessing and communicating tools and methods from national and European projects. The stakeholders' experiences were collected and analysed and best dissemination practices for spreading out and exploiting outcomes from STEM education projects were identified.

Context overview

I. RATIONALE

The DESIRE project based its results on data collected from stakeholders involved in 31 national and European STEM education projects represented in the figure below.¹



Figure 1 –Projects from which data were collected in the DESIRE project

The data was collected through questionnaires and discussion events from stakeholders participating in research and innovation projects funded by the European Commission (7th Framework Programme, Lifelong Learning Programme, etc.) or by other institutions, such as Ministries of Education of different countries, public or private organizations or societies.

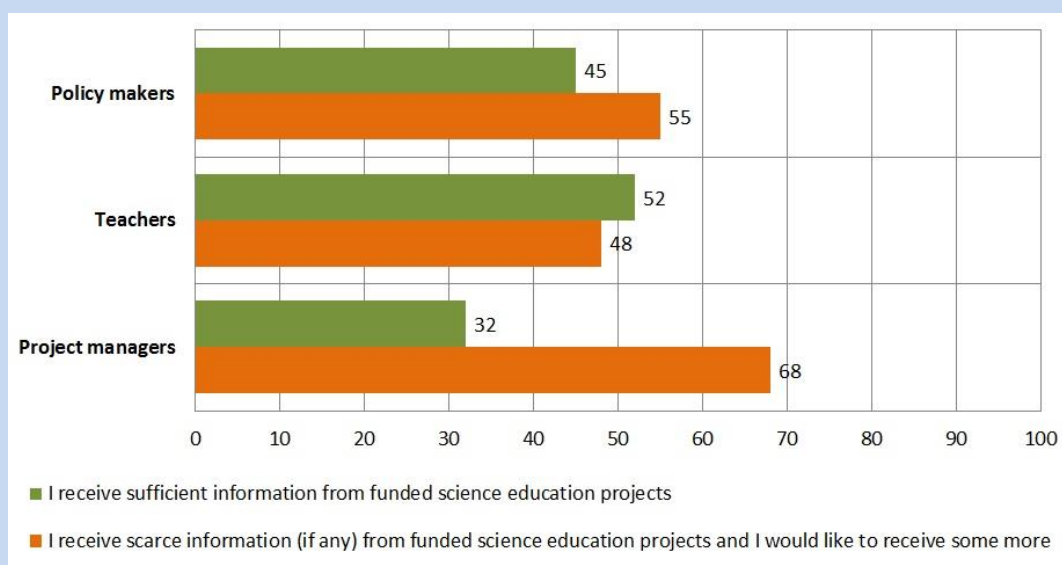


Figure 2 – Stakeholders' (policy makers, most active STEM teachers in Europe, project managers) perception of the amount of information received from science education projects

As seen in Figure 2 about half of the most engaged and active STEM teachers in Europe (n=105) who have participated in European or national research projects involved in the DESIRE project feel that they do not receive enough information about the outcomes from European and national STEM education projects.

¹ The list of projects that contributed to the results of the research summarised in this Reach Out Toolkit is available in Annex 1

Likewise, STEM teachers who do not usually participate in funded projects receive much less information on projects' outcomes or do not receive any information at all, since they have neither direct network nor direct connections to research or innovation projects.

Similarly, around two thirds of project managers (n=26) consider that they do not receive much information about the outcomes from European, international or national projects. The remaining third consider they receive sufficient information or that it should be possible for everyone with Internet access to find (or opt to receive) as much information as needed but often information is not easily accessible.

More than half of policy makers (n=15) also have the perception that they do not receive enough information on European projects' outcomes.

There are multiple funded projects in STEM education around Europe each year. Their goal of changing existing teaching and learning practices sometimes has a low impact and the outcomes are often not used as expected. Thus, educational policy-making continues to place emphasis on the dissemination and exploitation of project outcomes as a mechanism for quality improvement in education. This was the main focus of the DESIRE project, which is intended to analyse possible obstacles and facilitators to promote more effective dissemination and exploitation of STEM education project outcomes, preventing them becoming "sticky" to the original context or rapidly lost.

Before entering the heart of the subject, here are some details on how the DESIRE Reach Out Toolkit was developed and how it should be used.

II. WHAT DO WE MEAN BY DISSEMINATION AND EXPLOITATION IN THE DESIRE PROJECT?

Taking into account the different perspectives on dissemination, the DESIRE project considers the most global definition as **the process by which, using certain strategies, results of a project are made available, comprehensible and usable by potential users**. That is to say, we do not consider dissemination as merely referring to making results available but making them potentially exploitable. On the other hand, we consider exploitation of results as an action that can only be carried out by users when adapting and implementing the disseminated results. Accordingly, we will consider that **a certain dissemination strategy has a positive impact in practice when it is exploited, that is to say, when it contributes to the awareness, understanding and utilization in the expected way of the disseminated results on the part of the target audience**.

Hughes (2003) highlights strengths and weaknesses of different models of dissemination from strategies that are more traditional and linear to others that are more participative and interactive. In the more traditional models, the stakeholders have a passive role in the dissemination process and the knowledge transferred remains intact. In models that more participative, the stakeholders play an active role in the dissemination process while knowledge is co-developed, applied to the context and driven by users' needs.

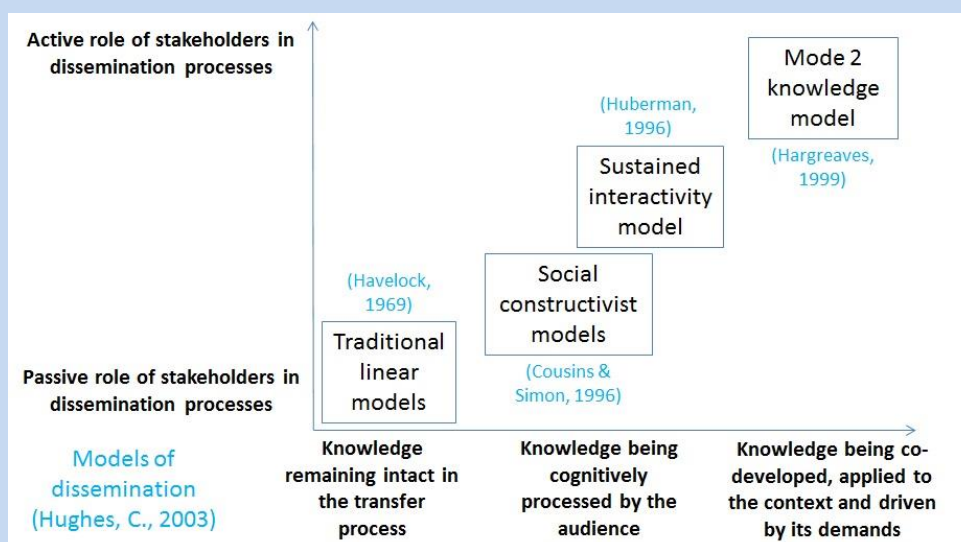


Figure 3 –Models of dissemination proposed to bridge the academic/practitioner gap

The research carried out by the DESIRE project shows that most of the **models of dissemination currently used** in funded projects on STEM education seem to combine channels and strategies characteristic of **traditional linear models** and **social constructivist models** (e.g. wide use of reports, websites and conferences as dissemination channels, face-to-face participatory techniques to interact with stakeholders).

The recommendations provided in this Toolkit coming from different stakeholders tend to advocate dissemination models which assume wider involvement of target audience and already existing institutions and networks as intermediaries with an active role in dissemination actions, which is a characteristic of the **sustained interactivity model** or of the **Mode 2 knowledge model**.

Table 1 below gives an overview of the stakeholders who disseminate STEM education project results, the content that is disseminated as well as the way the dissemination is done and the target of these processes.

Who disseminates? <ul style="list-style-type: none"> ▶ STEM Project Managers ▶ Researchers ▶ Communication experts / teams ▶ Teacher trainers ▶ Intermediate agents 	To whom are results disseminated? <ul style="list-style-type: none"> ▶ Teachers ▶ STEM communicators, science centres and museums ▶ Policy makers ▶ Project managers
How are the results disseminated? <ul style="list-style-type: none"> ▶ Text-based channels (e.g. flyers, brochures, leaflets, policy briefs, written materials, articles) ▶ Web-based channels (e.g. online social networking, portals, websites, videos, emailing) ▶ Face-to-face strategies (e.g. events, conference, workshop, seminar, communities of practice) 	What is disseminated? <ul style="list-style-type: none"> ▶ Teaching, learning and assessment materials ▶ Teacher education materials ▶ Guidelines or recommendations of good practices ▶ Theoretical contributions or review of already existing literature ▶ Findings from empirical research studies ▶ Repository of resources ▶ Established networks of people

Table 1 – Overview of stakeholders, target, method and content involved in STEM education dissemination process

In this Reach Out Toolkit we distinguish three forms of dissemination: **paper-based strategies**, **web-based strategies** and **face-to-face strategies**.

III. WHO WERE THE STAKEHOLDERS CONSULTED FOR THE PRODUCTION OF THE DESIRE REACH OUT TOOLKIT?

The DESIRE project organised data collection from four stakeholders groups from different European Union countries involved in one or several funded projects, namely:

Project managers, defined as coordinators, managers and researchers of finished or on-going European and national funded projects that produce and, in some cases, research about methods and/or materials to improve STEM education.

Science communicators, i.e. communication experts involved in disseminating science more broadly, both as science event managers and as science communicators in centres and museums.

Advisors of policy makers involved in the decision-making processes in the education systems of Europe including educational experts having the role of evaluators, advisors or counsellor of policy makers at national and European levels.

Teachers are primary and secondary school teachers who are actively teaching STEM in different European school systems.

IV. WHEN AND HOW IS THIS TOOLKIT USEFUL?

The DESIRE Reach Out Toolkit gives you information on how to plan and implement dissemination and exploitation strategies. The objective is to give you the tools to contribute to improving STEM education as a STEM stakeholder.

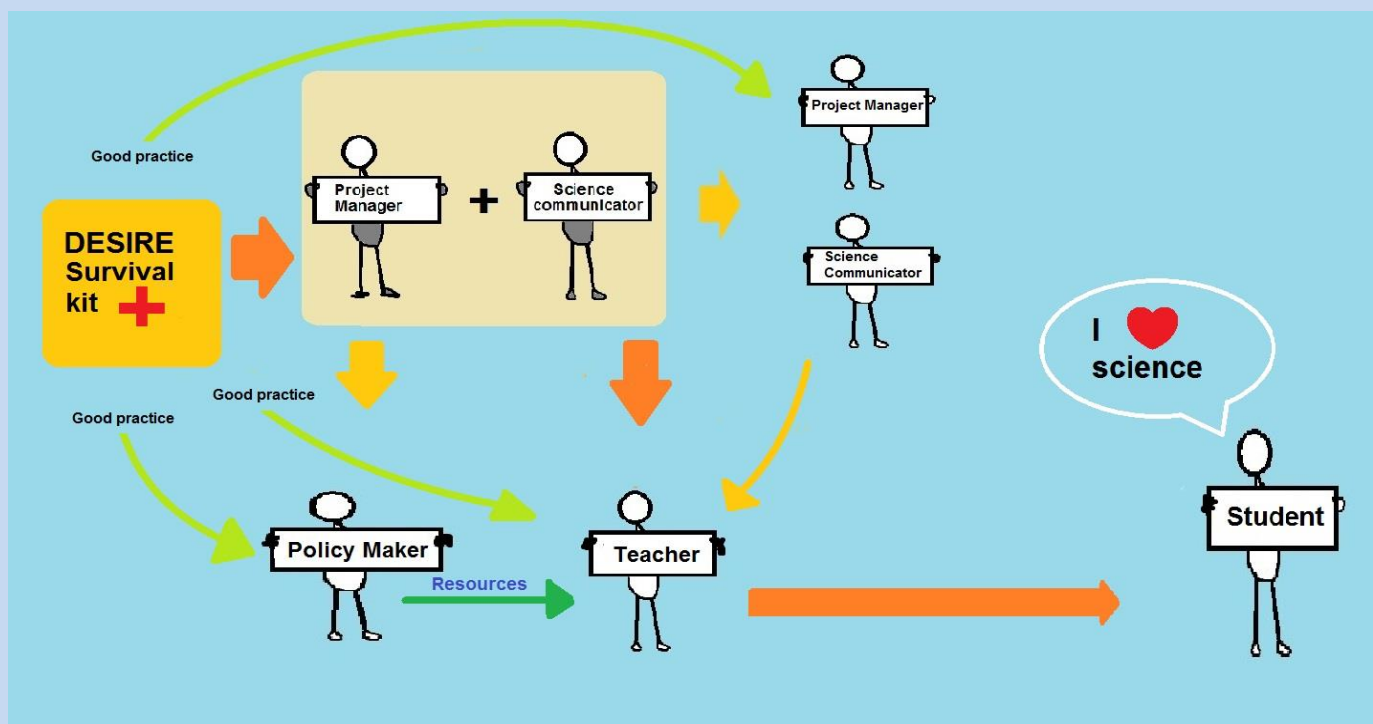


Figure 4 - Targets of the DESIRE Reach Out Toolkit

[Dissemination] It is like throwing a stone into water.

*If you throw it nonchalantly into the water, it will only make a little splash.
But if you throw it in a more elaborate way, it will ricochet across the water,
and make a lot more waves.
(SALTO-YOUTH Inclusion Resource Centre, 2010)*

Chapter 1. Dissemination

Managers of STEM education projects produce evidence, knowledge and tools to improve STEM education. Dissemination of results is most of the time a contractual obligation for research initiatives supported by the European Union or national institutions.

Concretely, transferring information to teachers, politicians and other stakeholders involved in education can be a slow and sometimes difficult process. Planning an effective dissemination strategy and knowing your stakeholders' habits and preferences in accessing information will give you a great advantage. This chapter will help you structure your dissemination strategy.

We look at where and when the information should be disseminated but also at the content of your communication and the way to get your message out to your target audience:

- ▶ The first section is devoted to dissemination to teachers
- ▶ The second tackles dissemination to STEM project managers
- ▶ The third one the reach-out to advisors of policy makers
- ▶ The last one looks at recommendations for disseminating to science event organisers and science museum professionals

In each section we propose to look at three main questions regarding the dissemination of STEM education:

- ▶ What content or information should be disseminated?
- ▶ How to communicate
- ▶ When to communicate

I. REACHING TEACHERS

In this section you will find advice and recommendations on communicating the results of your projects to teachers.

We start by defining the type of STEM education content that is produced by projects and then look at how it should be communicated to teachers. Finally we offer some recommendations on how to design the timeline of dissemination carefully.

I.1 What content or information should be disseminated to teachers?

When referring to STEM education, we should take into account four arenas of practice, distinguished by Fensham (2004):

1. **Teaching and learning tools including assessment:** This arena includes teaching, learning or assessment tools (e.g. tools to help students organise their ideas, such as concept maps, teaching strategies such as POE or discussion of rival concepts, analogies, models, diagnostic tools for formative assessment or self-assessment).
2. **Curriculum development:** This arena includes new curricula.
3. **Teacher education:** This arena includes materials and approaches for professional development and teacher education.
4. **Policy:** This arena consists of guidelines or recommendations of good practices.

When planning and assessing your dissemination strategy, try to start from these questions:

- ▶ To which arena does the disseminated information belong?
- ▶ To what extent and how would you like these materials to be disseminated to teachers?

I.2 How to communicate with teachers

When designing your strategy to disseminate results of STEM education projects to teachers, a number of elements should be taken into account:

- ▶ What information do users need and does its content have local relevance?
- ▶ Do the teachers have the resources to receive and understand the information?
- ▶ What is the most appropriate and effective information format and dissemination strategy to reach the target audience?
- ▶ Do users perceive the source to be competent, experienced and trustworthy?

To answer these questions, the DESIRE project has collected data from a survey and, thanks to testimonies gathered from discussion events, we have formulated a number of recommendations and tips to address them.

A strategy to reach out efficiently to teachers should be participatory, place the teacher in the centre and take local realities into consideration. To best communicate to teachers, you must take the constraints and opportunities of their curricula into account and consider their lack of time and recognition when taking part in European or national STEM projects.

Table 2 below summarises the main recommendations for building a successful dissemination strategy where the teacher is the main target:

We recommend you	Why?	See what they think!
Make sure your strategy is participatory	<ul style="list-style-type: none"> Teachers benefit from your communication skills and experience, and you benefit from their knowledge of the field. You ensure the results are oriented towards teachers' needs, you learn teachers' constraints (classroom situation, the school structure or the curricula). Teachers think and speak like teachers: your project results will be communicated in a comprehensible way and contribute to the exploitation of your results. 	<p><i>"Collaboration with teachers can be a real win-win opportunity, where they benefit from your communication skills and experience, and you learn from their knowledge of the field."</i></p> <p>UK Project Manager</p>
Make teachers actors of the dissemination, involve local institutions, use a decentralised model	<ul style="list-style-type: none"> By having teachers reaching out to other teachers with your project's outcomes you reach local levels more effectively: teachers often know and have access to local communication channels and communities for teachers. When choosing materials to circulate resources, consider the user's ability to relate to that resource. A video referring to a very distant reality is less likely to make an impact on teachers and their class if it does not connect to feelings and experiences they are already familiar with. It is important to think of the applicability of the contents to the local context. 	<p><i>"About the dissemination, we organize every year the 'Let's do physics day' in which we invite the primary schools to our laboratory, and we have had invitations from many local schools to carry out our experiments."</i></p> <p>Romanian school teacher</p>
Identify how to communicate in a relevant and effective way	<ul style="list-style-type: none"> Teachers don't have much time and might sometimes have to navigate through excessive amounts of information when searching for new teaching methods and materials. 	<p><i>"The time that a teacher wastes just looking for the materials for class is an enormous waste of resources."</i></p> <p>Italian school teacher</p>
Investigate on the STEM curricula of the involved countries upstream	<ul style="list-style-type: none"> You can find out where and how project results are useful to teachers by mapping their national curricula² and knowing more about the school system's³ flexibility to integrate new methods and materials. This will enable you to present the results in such a way that they can be used within the curriculum. 	<p><i>"The project should be related to the curriculum."</i></p> <p>German headmaster</p>
Use incentives to engage and encourage teachers and schools to participate in your projects	<ul style="list-style-type: none"> The incentives can be equipment for the school, training, social and institutional recognition for the individual teacher, opportunities to participate in workshops, financial support, reward systems for active teachers, showing success stories on online portals, or international partnerships in funded projects. 	<p><i>"It is rewarding to be involved in an innovative project because it reinforces my background in STEM education and helps me keep up to date with my knowledge and skills"</i></p> <p>Portuguese school teacher</p>

Table 2 – Recommendations: How to disseminate STEM education project results to school teachers

² For more information on mapping national curricula, see the SECURE project - <http://www.secure-project.eu/>

³ For more information on school systems, you can consult the results of the Eurydice study - <http://eacea.ec.europa.eu/education/eurydice/>

I.2.1 Shaping your message:

Below, you will find a number of tips to help you best shape the message you want to pass on to teachers. You need to tell a story, use pictures and videos, present your message as a solution to some of their challenges and make teachers aware that your project results are validated practices and methods and easy to use.

► Convey key messages to teachers

Whether to educate, discuss, promote or advocate, you need to have a story to tell. Within every story, key messages are the ones you want your teachers to remember and react to. Within all your writing, materials, presentations, workshops and content online, key messages keep you on track with what you are trying to accomplish.

► Use images to support your messages

Keep in mind how effective images are in building a story and channelling your message to your audience. If you effectively associate words with images or video you will increase your impact on their attention and memory. This recommendation relies on the principles of visual communication. Human brains react first on visual elements and secondly on words. In addition, emotions will have a greater weight in the process to take decisions and actions than rational reasoning. This leads to the rationale for giving a significant space to visuals when attempting to communicate a message to teachers and trying to change their behaviour.⁴

► Put yourself in the teachers' shoes

Start by reflecting about the purpose and how teachers can use the project results. Consider their problems, tasks, for which the results can provide a solution based on your input of knowledge or information. The project should create several focus groups of teachers to work on the one hand on the message to be delivered and on the other hand on providing feedback on the message proposed.

► Make teachers aware your project results are validated practices and methods and easy to use

According to many teachers, it motivates to know that new tools and methods are easy to use and the pedagogical benefits are high. This will encourage them to participate in innovative STEM projects or use their results. You should identify and list the added value of the project outcomes for teachers in a very early phase of the project to structure your dissemination strategy.

Give support to teachers, not resources alone! Many teachers highlighted the importance of receiving guidelines and support from partners to better understand and apply what has been disseminated.

⁴ Seeing is Believing, Resource Media's new best practices guide on visual storytelling, gives you the latest research and tools to address this communications blind spot. <http://www.resource-media.org/wp-content/uploads/2013/04/Visual-storytelling-guide.pdf>

I.2.2 Communication channels

When you have carefully defined your dissemination strategy and shaped your message, you should consider the most appropriate channels for communicating with them. These might include an e-bulletin, conference, workshop, leaflet, press release, event – or broader methods such as media and a project website.

Social media and virtual Learning environments

Social media are broadly used and a dissemination strategy that does not include these powerful tools would be out of the current trends in communication, however it is important to use them wisely and keep certain elements in mind. Virtual communities and networks can greatly help you create, share, and exchange information and ideas with teachers. Through the DESIRE discussion events, teachers expressed their view on a number of social media from:

- ▶ **Moodle, Edumodo**⁵: recognised as ideal social media as they are controlled, secured and closed online areas
- ▶ **Pearltrees**⁶ or **Diigo**⁷ highlighted as facilitators that help teachers connect and share resources and save addressees and explanations
- ▶ **Learning Resource Exchange**⁸ or the **eTwinning**⁹ platform (project galleries and resources project kits) are seen as great sources of materials for teachers
- ▶ **Facebook**: the fact that it allows good viral effect and that it is a fun channel to use is appreciated. Weaknesses perceived are the fact that getting information from science projects requires being very active on the platform and the issue of differentiating private and professional activities
- ▶ **Twitter**: is appreciated by teachers as they can receive information as an audience or they can just send information. The strength is that they can filter the kind of information they receive. It is seen as very easy and comfortable to use.

Keep in mind that:

- ▶ Teachers use social networks and mass media in their native languages
- ▶ Be brief and to the point when you write in social media
- ▶ Most appropriate social media are the national platform for teachers, school websites having social media functionalities, school online journals and educational blogs.

⁵ See: <http://www.edmodo.com/about> for more information on **edumodo**.

⁶ See: <http://www.pearltrees.com> for more information on this tool acting as an extension of the Internet browser to reference the favourite web pages.

⁷ See: <https://www.diigo.com/> for more information about this research tool and knowledge-sharing community.

⁸ See: <http://lreforschools.eun.org> for more information on Learning Resources Exchange for schools, a service that enables schools to find educational content from many different countries and providers.

⁹ See: <http://etwinning.net> for more information.

Websites

Even if it seems obvious, remember that it is essential to create a project website or use an existing one to highlight your findings, achievements, publications and ambitions. A website can also be used to give a very detailed summary of your project.

You can also consider creating a page as part of an existing website on STEM education to create economy of scale. Teachers can be pre-consulted about their used communication channels. They can often mention specific local or national websites and social networks that are used a lot to reach teachers audience at a national and local level. Many platforms exist at European and national levels for STEM teachers to access and share scientific and pedagogical materials and to discuss essential challenges and opportunities they encounter.¹⁰ It is not always a good choice to create a new portal.

If you decide to develop a website for your project, keep in mind that, as your website certainly has different targets (teachers, policy makers, project managers, etc.), you can consider creating different sections in function of the public you are talking to. Often, project websites are quite corporate and mainly designed to communicate to other project managers and policy makers. Many teachers highlight the need for improvement of project websites. Teachers especially complain that they easily get lost between messages.

A basic requirement to produce a user-friendly and useful website is to test it with teachers and adapt it according to their needs and reactions.

Adding videos to your website is a good solution to make sure your message is passed on to your audience. It will help increase the time spent by teachers on your website thanks to an interactive experience for the user. Videos enable to convey more information in a shorter time than written texts. This will help you reach teachers who like multi-tasking, listening to your message while they browse the Internet for example. It will also build a closer relation through a voice.

To help reference your website and ensure your resources and materials are disseminated widely in Europe, a key recommendation is to add your results to the Scientix platform, the platform for STEM teachers in Europe funded by the European Commission. This community for STEM teachers in Europe was created to facilitate the regular dissemination and sharing of know-how and best practices in science education (and STEM education in general) across the European Union.¹¹

Information on project, pedagogical resources and events from public funded STEM education initiatives are gathered in this central platform during the lifetime of the projects and after their end. The Scientix platform contributes to the sustainability of your resources and projects.

¹⁰ In Annex 2 available in the online version of the Toolkit, you will find a list of STEM portals for teachers at European and national levels

¹¹ see <http://www.scientix.eu>

Presentation and face-to-face events

Include traditional events (conferences, seminars, workshops) throughout the territory to meet more teachers, including conference and training workshops organised by other actors (teacher associations, science centres or festivals). Your presence there is necessary for them to meet concretely your results. To make this possible, remember to allocate resources for face-to-face activities.

Strengths	What they think...	Keep in mind
Presentations and face-to-face events allow quality dissemination, target is reached effectively, with a certain degree of interactivity among participants	<p><i>"In Portugal, the teachers' training centres would be the best way to disseminate project outcomes and learning!"</i> School teacher, Portugal</p> <p><i>"[...] practice is what leaves an imprint on what the teacher was taught in that course."</i> Teacher ambassador, UK</p>	Teachers find that conferences, seminars and workshops are important and one of the best ways to gain new knowledge and be informed about projects.

Table 3 – Recommendations on dissemination activities at face-to-face events

To sum-up on the choice of communication channels, remember that when several projects and partners are working in similar areas there is always a danger of overlapping with very identical messages and activities. Teachers benefit better from the innovation resulting from STEM education projects if online dissemination channels and face-to-face events are combined. Practically, good web dissemination should always be coupled to direct contacts, to participation in conferences and events.

A good suggestion is also to make economy of scale creating synergies between projects when disseminating your results. If feasible in terms of project timeline and logistic constraints, organising one national conference on a theme between several projects is a good way to share time and resources. Projects presenting in each other's events increase the impact of each initiative.

Presenting and discussing a certain project's outcomes in a session embedded in a series of conferences, seminars or workshops for teachers within an on-going professional development programme can be also useful for teachers. These measures can also avoid confusing and overloading teacher with too much information.

Finally, if you are involved in the coordination of a European project, do not limit your communication to the European level, use national and local channels. Many teachers agree on the need for fostering national multipliers who already communicate with schools and teachers (Ministries of Education, STEM communities, teachers associations, and individual teachers). Prioritise local or regional dissemination strategies! Do not forget to propose your dissemination materials in national languages so it can be used at a local or regional level and to foresee a budget for localising dissemination materials.

A good suggestion is to make economy of scale creating synergies between projects when disseminating your results. If feasible in terms of project timeline and logistic constraints, organising one national conference on a theme between several projects is a good way to share time and resources. Projects presenting in each other's events increase the impact of each initiative.

I.3 When to reach teachers

In the previous points, we have looked closely at the content and the method to disseminate your STEM education project results to teachers; now we offer some advice on the timeline of the dissemination:

► Pay attention to the dissemination timeline!

You will need to send out differentiated messages during the timeframe of the project. At the beginning of a project it is better to focus on awareness of the project, and at the end on “selling” achievements. A timeline will help you structure this process.

► School calendar

There are periods in the school year where it can be difficult to reach school staff. Take into account the special characteristics of teachers in terms of school commitments. For example teachers may not be available during summer holidays or other school holidays and exam periods.

► Allocate more time to dissemination

Teachers who have helped to carry out dissemination tasks in European and national projects expressed the need for more time to disseminate in order to get more people interested and aware of the outcomes of the project.

Usually a message has to reach teachers in several ways before it has an impact. Therefore the messages should be spread through various channels and tools. And this often requires more time than is usually assigned in most dissemination strategies.

► Create continuity and sustainability

Finally, when writing your proposal consider how engaged teachers can benefit from your project after your project has ended. Some teachers expressed the view that teacher networks created during a project period have no reason to end but can be leveraged after the ending of a project. The networks you established for the project may be used for other projects and can ensure continuity in dissemination after a finalised project.

I.4 Good practice - Spreading out new knowledge to teacher colleagues

To conclude the part of this Reach Out Toolkit devoted to the dissemination of STEM resources from projects to teacher, this story will inspire your work and help you understand the power of peer dissemination:

Mariana Buican is a Romanian chemistry and physics teacher with 28 years' experience teaching students in the 2nd and 3rd years (aged 12-14) at the gymnasium level in Romania. Mariana participated in her first European project in 2010 as a teacher coordinator in the Nanoyou¹² project and has since then taken part in two more European projects with great success in disseminating the knowledge she has gained to teacher colleagues at national level.

If you ask Mariana whether she finds it difficult to find time to search for, try out and test and communicate about new European teaching resources, she simply replies *"Yes it is difficult, especially to find the time, but you know how it is: passion can move mountains."*

When participating in the Nanoyou project in 2010, she discovered useful and innovative teaching online resources for her science classes. Mariana was very enthusiastic about the great success the lessons had had among her students. She felt the tools could be useful to and highly appreciated by other teachers in Romania. Mariana had already participated in several national projects which had made her familiar with creating online networks among science teachers to share knowledge on science teaching. Based on this experience she posted a Nanoyou advertisement on a national teacher platform encouraging teachers to form part of a national teacher network on Nanotechnology. This way she created a Yahoo group for 12 teachers from Romania who during the project were well engaged in testing and learning from the Nanoyou teaching resources.

Her first positive experience with disseminating the Nanoyou online teaching resources pushed her to participate in more European projects. She has also taken part as a pilot teacher in Nanochannels¹³ (2011-2012) and inGenious¹⁴ (2012-2013) with the gymnasium School nr.2 Zimnicea.

Mariana stated using Facebook as the main dissemination tool for the two new projects. It enabled her to reach out better to teachers at a national level and create more interactive communication with the interested teachers and students. She created a Nanochannels Facebook page that has 225 members and an inGenious Facebook page with 186 members. The Facebook pages were used to post teachers' opinions on the projects but also as a forum where teachers could post questions for students, teachers and parents or others who were interested in the projects. She also started disseminating the projects through Twitter and LinkedIn.

Mariana is currently glad to work in the inGenious project as it provides her with inspiring information she can try out with her students. As a spin-off benefit, she feels her students also get more motivated and engaged in her lessons by knowing they are involved in an innovative learning process. Mariana will therefore definitely keep on participating in European projects in the future.

¹² For more information on the Nanoyou project you can visit: <http://nanoyou.eu/>

¹³ For more information on the Nanochannels project you can visit: <http://www.nanochannelsfp7.eu/>

¹⁴ For more information on the inGenious project you can visit: <http://www.ingenious-science.eu/>

II. REACHING PROJECT MANAGERS

In this section you will find advice and recommendations on communicating the results of your projects to your peers, other project managers and coordinators working in STEM initiatives in formal and informal education.

We start by looking at the type of STEM education content to disseminate to project managers and then look at how it should be communicated. Finally we offer some recommendations on how to design the timeline of dissemination carefully.

II. 1 What content or information should be disseminated to project managers?

Project managers and researchers usually need to be updated about finished or on-going projects, their methods and outcomes. This will serve as an inspiration and starting point for them to (re)shape other initiatives or projects, to enrich or improve their resources for teaching or for teacher training, to collaborate with other professionals.

Bear in mind that project managers and researchers in STEM education might be interested in knowing your research studies' findings as well as your innovative resources, networks, materials or practices. You should share all kinds of project results.

When deciding what content from the results of your project should be disseminated, keep in mind some elements:

► **Think what you would want to know:**

If you are a project manager or a researcher in the field of STEM education, you already know what your interests are. However, remember that within your target group, there are very different professional profiles. Some project managers might have an academic background in a certain field, as university professors. They might also devote part of their time to teacher training and professional development. Other individuals within this collective might be completely focused on managing funded projects on a daily basis, without having a particular background on STEM education. Many of them usually combine all these facets. Think of your own needs as a stakeholder and you will be closer to other project managers' needs.

► **Balance the types of outcomes you produce in order to attune them to the project outcomes expected (by stakeholders)**

What project managers usually communicate to other project managers (synthesised articles and publications with key results) differs from what many project managers like to receive from projects (training packages/materials, classroom materials, and resources on scientific content accompanied by some support).

► **Tell project managers your research experience and spread good practice generating adaptive and supportive processes**

Projects should document experiences and present them in a flexible way. For instance, case studies which allow framing the experience carried out with attention to the context and boundary conditions, learning materials for students, scripts for teachers with a detailed description of how the materials were designed and used, movies of educational activities.

This will help spread good practice and generate adaptive processes so that stakeholders can learn from past experiences. In this sense, project outcomes would be expected to stimulate new initiatives that take account of previous research and are aimed at generating effective learning activities, and new ways of interacting with colleagues and researchers.

II.2 How to communicate with project managers

The table below summarises the main elements to take into account when designing the part of your dissemination plan devoted to sharing know-how and best practices with your peers:

We recommend you...	Why?	See what they think!
Attend and disseminate through traditional events on STEM education that project managers usually attend	<ul style="list-style-type: none"> ➤ Conferences and workshops are considered good opportunities to network and find out about project results and future project developments. It is an opportunity to keep up to date around certain strands taking into account the huge amount of information that flows in the digital era. ➤ Major events in STEM communication and education: Scientix, ESERA,¹⁵ NARST,¹⁶ IOSTE,¹⁷ PCST,¹⁸ ECRICE,¹⁹ GIREP,²⁰ ASTC,²¹ INSTEM,²² Ecsite,²³ EUSEA.²⁴ 	<i>"While I tend to think that, as a community, we should be using more online resources to meet, I think that conferences still play a key role in our community (STEM education)."</i>
Break old habits regarding communication channels and investigate new ones	<ul style="list-style-type: none"> ➤ Text-based channels: Project managers mainly produce articles in specialised journals and project reports or publications. Consider alternative strategies to writing reports. Try to communicate your key project outcomes using briefer documents or books collecting the outcomes from a funded project. ➤ Web-based channels: Project managers' efforts are usually put into websites and portals, whereas they use social media, mass media and online newsletters less frequently. Bear in mind which of these channels are used by project managers and try these alternative ways to reach project managers. 	<p><i>"Most of our time has gone into writing reports which are read by a very small number of people"</i></p> <p><i>"There is nothing more immediate and usable than having documents at your fingertips to rely on and good facilitators at an arm's (or computer's) distance".</i></p>
Give space to informal dissemination and be open to adapting your strategies depending on each context	<ul style="list-style-type: none"> ➤ Dissemination among project managers often happens through traditional word of mouth, which does not necessarily take place in formal events. Project managers are more likely to come across outcomes from projects that are addressed to a topic they are already engaged in through other projects. 	
Reach out beyond your network by making use of experts who have large networks in the STEM formal and informal education worlds	<ul style="list-style-type: none"> ➤ Ambassadors are expected to be very connected to other stakeholders, to be really passionate about the topic, and reach out to a wider audience. 	<i>"These people are usually proud of permeating to other people and they tend to bring massive added value to projects".</i>

Table 4 – Recommendations: How to disseminate STEM education project results to project managers

¹⁵ European Science Education Research Association

¹⁶ National Association for Research in Science Teaching

¹⁷ International Organization for Science and Technology Education

¹⁸ International Network on Public Communication of Science and Technology

¹⁹ European Conference on Research In Chemical Education

²⁰ International Research Group on Physics Teaching

²¹ Association of Science – Technology Centres

²² Inquiry for Science, Technology, Engineering and Mathematics Education

²³ European Network of Science Centres and Museums

²⁴ European Science Events Association

II.3 When to reach project managers

The same emphasis placed on the accurate management of the project timeline in the case of teachers is valid for project managers. You will need to send out differentiated messages during the timeframe of the project. At the beginning of a project it is better to focus on awareness of the project, methods and expected results, whereas at the end the dissemination should be focused on discussing and communicating achievements.

Many project managers can benefit from what has been already done in other projects and they try to build on it. Therefore, they suggest that dissemination should continue after a project finishes and a good way to promote further dissemination might be to use portals centralizing all project outcomes.

“Some very good tools and resources available on websites of finished projects are not disseminated any more as the funding has stopped. One solution is to use portals centralising all these project results, like the Scientix portal (www.scientix.eu)”.

Another way to further disseminate outcomes that have already been produced might be to start a new project or initiative focused on intensive dissemination and exploitation of results previously developed.

II.4 Good practice - Materials Science Project

To conclude on the dissemination of STEM resources to project managers, we provide an example of a dissemination strategy that we consider good practice.

The Materials Science Project is a university-school partnership for the design and implementation of research-based ICT-enhanced modules on Material Properties. It is funded by the European Union under the 6th FP Science & Society (2007 – 2010) and led by the University of Cyprus (Prof. Constantinou). The objective is the dissemination and exploitation of results to reach science teachers and science education researchers

Project overview

The main objective of the project was to develop a mechanism for focusing the collaborative efforts of experienced science education researchers and science teachers on using established principles and knowledge to solve teaching-learning problems in specific domains such as Materials Science. At the same time, the international expert group identified the crucial attributes that distinguish successful efforts to develop research-based teaching materials in such a way that these can be implemented in different contexts regarding systemic, cultural, organizational, and language characteristics. These differences generally impede transfer of educational programmes from one educational system to another. The critical attributes were turned into a set of curriculum development guidelines for science learning. In addition, the outcomes of the work of the expert group include a set of specific recommendations for successful transfer of examples of successful teaching practice from one educational setting to another.

In Tables 5 and 6, we provide an overview of dissemination and exploitation strategies that were used in the MaterialScience project at European, national and local levels.

Text-based strategies	Public project reports (These reports were delivered in due time during or at the end of the project): <ul style="list-style-type: none"> • Teaching / learning / assessment materials • Recommendations for design and evaluation of ICT-enhanced inquiry-oriented science teaching and learning materials • Recommendations for successful transfer of innovations from one educational context to another. 	
	Articles in journals (Most articles were published after the project was finished): Each partner presented different pieces of research or innovation carried out within the project, or explained the project itself, publishing a number of papers in: <ul style="list-style-type: none"> • Academic journals (e.g. Journal of Science Education & Technology) • Professional journals (e.g. Physics Education) 	
	Books (published after the end of the project): <ul style="list-style-type: none"> • The whole consortium wrote a book on the design and evaluation of teaching-learning sequences, which is edited by two of the partners. • Some partners wrote one or more chapters in other books, which include selected papers from international conferences with pieces of research (e.g. GIREP 2008, ESERA 2011). • The teaching-learning materials were edited and published as booklets with teachers' guidelines and students' worksheets (printed and as CD). 	
	Brief documents: Hundreds of brochures were printed with basic information on the project to be distributed in several events and among colleagues.	
Web-based strategies	Project website ²⁵ : This website summarised the project's aims, structure, methods, activities, dissemination actions and main outcomes. Other portals: A summary of the MaterialScience project was included in the Scientix portal ²⁶ together with a link to the project website.	
Face-to-face strategies	International conferences: Preliminary, intermediate or elaborated results of the project were presented in different formats (poster, oral, and symposium) in several international conferences, such as ESERA, GIREP, EARLI, NARST, Scientix, WCPE. These presentations were done during the project and after the project finished.	

Table 5 – Dissemination strategies at EU level in the MaterialScience project

²⁵ <http://lsg.ucy.ac.cy/materialsscience/index.htm>

²⁶ <http://tinyurl.com/lnvt42a>

Reaching Project Managers

Text-based strategies	Articles in journals: The partner presented some pieces of research or innovation carried out within the project, or explained the project itself, publishing a number of papers in professional journals. Some of these articles were published during the project whereas others were published after the project was finished.
	Books: <ul style="list-style-type: none"> • The partner wrote several chapters in other books in national or local contexts for teacher training purposes. These books were published after the project finished. • The teaching-learning materials were edited in the native language of the partner and published as booklets with teachers' guidelines and students' worksheets.
Web-based strategies	Other portals: <ul style="list-style-type: none"> • The partner included a summary of the project in their institution website including direct links to teaching-learning materials designed by the partner. • The partner included project information and outcomes on the website of a local resource and training centre for science teachers.
Face-to-face strategies	International or national conferences: Some project research outcomes were presented by the partner in an international conference in the partner's native language. Moreover, these results were presented in different partners' native languages in other national conferences.
	<ul style="list-style-type: none"> • Exploitation seminars: The partner organised two interactive seminars in the native language for teachers who were following a training course during the academic year. The seminars that they attended periodically were organised by a (regional) public institution, which is in charge of continuous professional development. Researchers or other teachers can prepare workshop or seminars during these sessions. Project outcomes on the design and implementation of a teaching-learning material were discussed with a number of active in-service teachers, who might in turn become disseminators of the results to their colleagues. However, the number of teachers reached in these sessions was limited (20-30 teachers) since most of them came from schools near the place where the training took place.
	<ul style="list-style-type: none"> • Face-to-face participatory approaches for the exploitation of results: Professional communities of practice were formed including a small group of teachers (less than 10) and three researchers in science education. They all shared the tasks related to the design and evaluation of educational materials. In periodical face-to-face meetings, they shared knowledge and research outcomes resulting from the project. However, these face-to-face events involved few people because they demanded very active participation. The teachers involved in this community of practice became disseminators themselves, involving some of their colleagues (from their schools) or participating in seminars.

Table 6 – Dissemination and exploitation strategies at national and local levels in the Material Science project

III. REACHING ADVISORS OF POLICY MAKERS

In this section, we address the strategy for dissemination to advisors of policy makers, key target to impact the education practices and framework on the long run. We look at what content is disseminated to policy makers, and how and when they should be reached.

The recommendations formulated in this section take into account the fact that generally, politicians do not necessarily have a STEM background. They rely on advisors, researchers and experts who bring together ideas or look for new ideas before taking decisions and implementing measures for projects and programmes. For this reason, advisory boards are usually considered relevant as intermediate stakeholders to reach policy makers.

III.1 What content or information should be disseminated to advisors of policy makers?

Facts and products from funded projects and projects proposal are important to better judge directions and measures for future funding programmes. As policy makers often do not have much time to look for this information they tend to prefer brief and concrete information.

One of the key elements is to guarantee to policy makers that the outcomes of the project have been successfully used and validated as potentially viable.

Due to policy makers' involvement in executive policy strategies, they have strong interest in having information on the project outcomes: They need to show results and progress in their policy field.

STEM advisors of decision makers find interest in receiving teaching and learning material, repositories of resources and practices but also information on networking establishments as a result of project efforts. Also recommendations and good practice are considered useful information. Therefore, this is what they ask from their advisory boards.

The least used sources of information they look for are literature reviews, theoretical contributions and empirical research findings.

III. 2 How to communicate with advisors of policy makers

When designing your strategy to disseminate results of STEM education projects to advisors of policy makers, a number of elements should be taken into account; they are presented in this section.

► Communication channels

Around half of the advisors of policy makers said they do not receive enough information of European projects' outcomes. The question is: what can projects managers improve so as to reach out better to policy makers?

The data gathered from the DESIRE project shows that advisors of policy makers make use of media-based, text-based and face-to-face communication channels to receive information on projects:

- As regards text-based information, advisors of policy makers prefer brief documents like flyers or project reports (possibly short versions).
- As regards media-based strategies, the Internet is the main gate to get informed. Mass media, Internet forums or newsletters are commonly used source of information for advisors of policy makers.
- Face-to-face dissemination, like traditional fairs, conferences, and seminars, are the most used official means for advisors of policy makers to get informed. This is not surprising since policy makers due to their political function are often invited to attend events to give speeches and to support certain initiatives politically.

► Use and expand your policy network

The majority of the advisors to policy makers we questioned stated, however, that their main information source when it comes to information on project outcomes are people in their network, people with whom they already have an established relationship, introducing partners of a project.

► Invite policy makers to face-to-face events

Policy makers need visibility. Remember to invite policy makers to face-to-face events. This is a twofold strategy since in this way you provide them with the "political arena" they are always looking for and you have the chance to strengthen your cooperation with them since they get to know you better than in other ways.

► Rely on existing networks informing policy makers

Dissemination strategy for decision makers should rely on existing networks which are informing them regularly. As an example, Scientix National Contact points are essential to facilitate the transfer of information on STEM project results to decision makers as they are created and nominated by the decision makers themselves.

► Best practices to reach policy makers

Some of the successful strategies mentioned by policy makers relate to the fact of being involved and informed of the project at an early stage by the project team.

Moreover, the language is considered a barrier by about half of the interviewed policy makers when it comes to in-depth reading about project outcomes. Here the fact of being informed at the beginning of the project is an added value for having the time to become familiar with the project.

Another advantage of involving and informing policy makers in an early stage about projects, is that policy makers move around publicly and can be used to disseminate your project. About 70% of the questioned policy makers mentioned that they had been involved the dissemination process of a project. Don't forget that results and progress in the policy field of education is an important success criterion for politicians that you can support them with.

Advisors of policy makers involved in the DESIRE activities shared useful recommendations that project managers should bear in mind. The method described in the table below is the MICE rule, useful when targeting policy makers:

M (mass media and multi-channel strategy): improve the use of mass media to reach the general public, not only relying on the Internet, which is of course the first means of dissemination.	<ul style="list-style-type: none"> ➤ Policy makers look at the mass media since they need them to reach large audiences ➤ Existing media haven't disappeared because of the Internet; they should be used in a more specific way but they keep their high potential for reaching masses.
I (involvement): stakeholder involvement at early stages of the projects (policy makers at all level, teachers, local communities, etc.).	<ul style="list-style-type: none"> ➤ Policy makers are accustomed to consensus raising processes and in these processes the involvement of people is crucial.
C (clarity and crucial information): communication should be clear, mainly using brief messages (better in native language) and crucial evidence on which policy makers can their plans and measures.	<ul style="list-style-type: none"> ➤ Policy makers need crucial information in order to advocate certain measures and projects. Due to time constraints they are often unable to read long research reports but they still need relevant and sound information.
E (evidence): dissemination strategies should communicate clearly how theory and practice can be bridged, for instance between pedagogical theory and teachers' practice.	<ul style="list-style-type: none"> ➤ Policy makers emphasize that pedagogical theory and research is not well bridged with teachers' practice. This may depend on several factors but it is important to shape the message in a way that end-users understand how research outcomes can be used. ➤ "Education is an applied field, like engineering", says Michael Atherton, researcher in the Department of Educational Psychology at the University of Minnesota, and we should remember that the first players for making it possible are policy makers who draw up reforms, set out rules, finance projects and so on.

Table 7 – Recommendations: How to disseminate STEM education project results to advisors of policy makers. The MICE Rule

III. 3 When to reach advisors of policy makers

In the previous points related to dissemination to advisors of policy makers, we have looked at the content and the method to disseminate your STEM education project results; now we will give you some advice on but you should also carefully look at the timeline of the dissemination:

▶ **Pay attention to the dissemination timeline!**

In order to draw the attention of policy makers, you need to consider their profile. From the data we got from questionnaires and discussion events, policy makers (and/or their advisors) like to be involved from the beginning. The first action to disseminate the project is informing them at an early stage of the project, so you need to plan some dissemination steps right at the beginning. You could involve them with a specific role, such as “external observer” or “advisors” or include them in some project boards. This will guarantee sustainability later on.

▶ **Create continuity and sustainability**

Based on the active involvement you create with policy makers, your project can permeate other project areas. After the project has finished, if the results are satisfying you could then start considering mainstreaming strategies enabling the results of your project being spread out at a large scale. It could be either subject of new pilot initiatives or being part of a more radical transformation of some education approaches.

IV. REACHING SCIENCE EVENT ORGANISERS AND PROFESSIONALS FROM SCIENCE MUSEUMS

Even if teachers are your primary target, you should also aim to involve other stakeholders. You should include organisers of informal science events and science museums, as they are efficient multipliers to spread new practices. In particular, science centres and museums regularly organize teacher training events: if they adopt your result, it will be presented to hundreds of teachers. Reaching them can be tricky as many regions do not have science centres, but, they are usually eager to discover innovative approaches.

In the following section, science event organisers and science museum professionals will be referred to as science communicators.

IV. 1 What content or information should be disseminated to science communicators?

As can be imagined, any content related to innovative learning materials is helpful for science communicators, as is information about other science education projects. Thus, the contents for teachers and project managers are relevant in this section as well! However, a specificity of informal science education professionals is their interest towards innovative approaches linking science and society. These may include:

- ▶ **Innovative approaches of inquiry-based learning:** unusual contexts for science education that can be unusable for teachers are extremely relevant for informal science experts.
- ▶ **Participative approaches and in general horizontal or bottom-up methodologies,** such as projects that enable collaboration between academics, citizens and enterprises. The processes that directly or indirectly involve non-scientists have a great value: crowdsourcing, opening data to the public, or participation of amateurs in the gathering of data are of high interest.
- ▶ **Materials that focus on engagement,** opinion forming, or ethical debate rather than science knowledge transfer only, such as discussion games or scenario workshops.
- ▶ **Actions that allow citizens to have an impact** on science, science communication, research planning or funding schemes.

IV. 2 How to communicate to science communicators

Newsletters and articles are crucial to science communicators, as they need to be aware of the latest trends in the field. National and European network channels should be used to promote your results. Though these stakeholders appreciate social media, the most efficient way to have your resources adopted is to present them at physical events, where science communicators can meet the project team.

Do not restrict yourself to conferences and workshops, but aim to be present at science festivals and informal education events, as communicators like to see methods in practice. Physical networks are usually more reliable than virtual ones in spreading a practice. Partnering with some major science centres which will relay towards others is obviously an efficient strategy.

Bear in mind that professionals of the informal STEM education sector have their own needs. Even if your materials are made for teachers, there must be a way to use them out of the classroom. How could your resources be used at science events? Find a way and you'll have some science communicator test it with their audience, before spreading it among teachers. Some websites and

information points, such as <http://research2practice.info>, are specifically built for informal learning research, and are thus widely used in the science communication community.

One of the main challenges is to have a resource that is adaptable to different contexts. In the table below we share some recommendations:

We recommend...	Why?	See what they think!
Choosing a broad and transversal topic	<ul style="list-style-type: none"> ➤ The topic can be used by a wide variety of actors. ➤ It can fit into different curricula. ➤ It is often linked to social issues, which is appealing for teachers and students. ➤ More students will find an interest in it. 	<i>"We try to focus on transversal topics to prove that STEM disciplines can and must interact. It's also a way to include every student!"</i>
Suggesting several ways of using the material	<ul style="list-style-type: none"> ➤ Your material can be usable by teachers, but also science communicators, parents, other students, etc. ➤ The user will find at least one relevant situation to use your material. 	<i>"Many users have no time to think about the possible uses of the materials: we have to suggest at least one way that suits them."</i>
Explaining a method to adapt the resource to any situation, ideally already tested and evaluated	<ul style="list-style-type: none"> ➤ If your material is a simple and generic one, it can be included in usual activities. ➤ Tools are easier to include than complete activities. 	<i>"Methods and approaches that can be adapted to any topic proved to be successful."</i>
Presenting the material as an inspiration, encouraging users to adopt it while adapting it adding a local character	<ul style="list-style-type: none"> ➤ Your material then doesn't need to be comprehensive. ➤ You focus on the originality rather than on the precision of the instructions. ➤ You leave room for the user's preferences. 	<i>"Most of the experiences cannot be exactly reproduced, but they do inspire other attempts."</i>

Table 8 – Recommendations: How to disseminate STEM education project results to science event organisers and professionals from science museums

A crucial strategy is to build several mechanisms allowing "user feedback". Another method is to create an advisory board or panel of "consultants" for the project, including not only academics but all kinds of people. Getting their view on intermediate reports and ideas is very useful.

Consider involving future users in the conception to ensure that the resource is adequate. Various involvements are possible:

- ▶ Future users being co-designers of the resource.
- ▶ A group of guinea pigs trying out the resource as it's being made.
- ▶ Future users being part of an advisory board, giving its opinion at different stages.

This group of users can exchange at a European level thanks to online tools. It could then be the start of an online community of users, which will be helpful for the sustainability of the results.

Last, keep in mind that most of the produced materials are text-based. Other formats, such as experiments, videos, games or other unusual activities are much rarer, but often more appreciated!

IV. 3 When to reach science communicators

You can reach science event organisers and professionals from science museums at all stages of the project, of course!

1. In the infancy of the project

At the beginning of your project, you need to create awareness and get the partners involved in this initial effort of dissemination. At this point, you explain about the methods and expected results of your project. If you need the participation of science communicators in the production of your materials, the collaboration should be built at this stage.

2. During the project lifetime

Draw attention to your project during the whole of its lifetime. You should identify relevant face-to-face opportunities to promote your project, using your network and relevant dissemination strategies. Always remember to credit your sources and keep them excited about your project. Some science communicators may even be willing to pilot test your first materials and give feedback to improve them.

3. Finalising the project

When you have final results to present, the goal is to then spread them as widely as possible and have them used! The innovative dimension and adaptability of your materials to different contexts are keys to reach informal science education professionals, and ensure the sustainability of your results.

Chapter 2. Exploitation

Not only do you need to reach teachers and other stakeholders, you also have to cooperate with them to actually facilitate their use of the results, offer them the resource in an easy-to-use format, help them to adapt it, make sure the activities will be a long-lasting success.

As defined in the context overview of this Reach Out Toolkit, in the DESIRE project, we consider exploitation of results as an action that can only be carried out by users when adapting and implementing the disseminated results. Accordingly, we will consider that a certain dissemination strategy has a positive impact in practice when it is exploited, that is to say, when it contributes to the awareness, understanding and utilization in the expected way of the disseminated results on the part of the target audience.

In other words, though dissemination is a crucial part of all projects, STEM education projects have to deal with an additional challenge: How can your results be effectively used by your targets? How can you facilitate the appropriation of these resources by the users in their daily work? Will the resources be used after the end of the project? This section proposes a number of recommendations to answer these questions:

- ▶ The first point looks at how take the needs of your users into account
- ▶ The second tackles the support to provide to your stakeholders
- ▶ The third one the sustainability of your STEM results
- ▶ The fourth one addresses the questions of copyright of your results
- ▶ The fifth point looks at how your results can be exploited to inform policy makers
- ▶ And the last one looks at how to involve project managers in your exploitation strategy

Below you will find a table listing the main stakeholders we consider exploit your STEM education results, the type of resources that are exploited and the premises where the results are exploited:

Who exploits?	What is exploited?	Where are the results exploited?
Teachers	Efficient methods and approaches	Classrooms training sessions
Researchers	Theoretical background	Universities, research centres
Communication experts / teams	Original topics Articles	Science communication events
Science centres and museums staff	Experiments Games and other unusual formats	Science centres and museums

Table 9 – Overview of stakeholders, target, method and content involved in STEM education exploitation process

In this chapter we do not propose strategies differentiated according to the profile of your target. We describe general methods and recommendations that were reported by the various stakeholders who took part in the discussion events of the DESIRE project and are valuable for the different stakeholders exploiting results listed in the table above.

We finally recommend informing two specific stakeholders: policy makers and project managers, to contribute to the success of your exploitation strategy and the sustainability of your project results.

I. ADAPT TO TARGET NEEDS AND DESIRES OF USERS

To ensure your resources and methods are taken over by the group you are targeting in the STEM education sector, you need to find a way to get feedback from users. To increase the chance that your results will be used, consider a mechanism to involve them in the development of your resources. You can consider one or several of the following methods to get feedback:

- ▶ **Run a user need analysis** before starting to design your resources to make sure the investment you will devote to your STEM education project answers a real need in the professional context of your target group.
- ▶ **Include a pilot phase in your project** to make your target group validate your resources, methods or product by testing it in their professional environment. This will particularly be the case for stakeholders who are directly working with students learning STEM. Teachers can test the outcomes of your project in class, museum and science centres professionals can assess your resources in workshops and other educational activities in their premises and give you direct feedback. On that basis, you will be able to adapt your resources and product to the public you target as they will be validated by their peers.
- ▶ **Organise focus groups, workshops, interviews or online discussion events** to get in-depth feedback on your results. Methods involving discussions prepared and run by an experienced moderator or interviewer will permit a thorough analysis of your resource by the group you are targeting. These methods takes time and require budget but ensure a higher quality of your final results.
- ▶ **Circulate a survey** to get a wider number of stakeholders providing feedback on the STEM education resources in a shorter time. You will be able to get general feedback and have an idea of whether your resource is perceived in a positive or negative way by your target group.

II. SUPPORT USERS TO EMPOWER THEM

Is your resource perfectly tailored for your target? The game isn't won yet. Now you have to keep in mind a number of elements to support the target of your STEM education project and empower them:

- ▶ **Provide adaptable results:** Users generally like and need to sculpt, change or adapt the materials that are provided to their own needs and context. If your resource looks like a complex and one-block finished product, users will not have much freedom with it. In order to use and manipulate it, the user wants to have a “hackable” material, something modular, that can be easily modified (aggregated or disaggregated) or used in other ways.
- ▶ **Create supporting documents or videos:** Your target also needs to know how to integrate bits and excerpts of the innovative contents and methods within well-consolidated and well-tested ones. Developing guidelines and supporting documents to accompany your educational resources, products or methods will be key to a successful implementation in the formal or informal education premises you are targeting. Proposing step by step activities integrating your resource will help your target to figure out how it can concretely be used.
- ▶ **Help your stakeholders:** Your material should include some theoretical background, some practical activities, and also an emotional dimension, involving the social relevance, the impact of STEM, and its relevance to the students' life. A content that is embedded within a story is more appealing, more functional and easier to apply in a classroom context. It should not only be thorough but also unique, exploiting some details that catch the eye, that have a special and striking twist.
- ▶ **Organise training activities:** your STEM education resources will be more effectively exploited by your users if you plan professional development in your activities. You have more chance that your targeted stakeholders feel confident to use your resource if they have spent time working on it in a collaborative session where it has been carefully explained how to use

it. The training can take the form of a face-to-face workshop or an online webinar; the main point is to empower your user.

III. HOW TO MAKE YOUR RESULTS SUSTAINABLE

To withstand the test of time your resource needs to be alive! Exploitation of your results will also be guaranteed if you make sure they continue being used and updated after the end of your project. This is a challenge in terms of funding but here are some solutions that can be considered.

- ▶ **Make your community of users live without you.** During the project you might have been devoted to building up a community platform for stakeholders at national or European level. Remember to encourage this community to share subject-related knowledge and to exchange on the way they use, modify, and experiment with your materials to have a proactive community that can live without the project's support.
- ▶ An alternative to community building during the project period is to **team up with other resource makers**, and to link with other platforms. Scientix is a good example of a European STEM education platform that can host your project result and make it visible to stakeholders after the ending of your project.
- ▶ **Make your project result generic.** Can your project result be of interest for more than your targeted STEM stakeholders? The results may also be valuable for unforeseen fields outside the education sector: industries, communication experts, engineers, or environmentalists.
- ▶ If your project result/recommendations support existing EU or national policy statements in the STEM education field, **make the policy makers aware**, so they are encouraged to use it as an argumentation basis for their policy statements.
- ▶ **Be aware of the teachers' trainers.** Whether it is initial or lifelong training, in formal or informal learning institutions, training that integrates your materials will make it survive.

IV. PLAN COPYRIGHT AND INTELLECTUAL PROPERTY ISSUES

Often you want to distribute your project results whilst you still wish to ensure that the consortium members and project are given the credit and acknowledgment and are referenced when used by third parties. The dissemination and exploitation of your project results therefore have to take into account issues related to intellectual property rights.

- ▶ The guidelines for project promoters of the Education and Culture projects and actions in the context of dissemination and exploitation of results²⁷ give good guidelines and information on essential legal issues, like Intellectual Property Rights or Personal Data Protection.
- ▶ Project partners should settle all copyright issues at the very beginning of a project. Intellectual property will legally protect the works created by the human intellect in your project. It is an exclusive right conferred upon the creator or/and the owner of an intellectual work.
- ▶ In addition, national or international legislation should be looked into details by a qualified copyright lawyer or a legal authority. You are strongly recommended to look for professional legal advice for the effective settlement of these issues and the best possible use of your project's results!
- ▶ A Creative Commons (CC) license offers several public copyright license solutions that allow you to give other people rights to share, use, and even build upon the work you have created. The CC proposes different level of protection of your results. You can find more information on

²⁷ Dissemination and exploitation of results of programmes of DG Education and Culture - Intellectual property rights:
http://ec.europa.eu/dgs/education_culture/valorisation/ipr_en.htm

Creative Commons licenses solutions on their website.²⁸ Teachers tend to reuse materials (i.e. using only parts, mixing with others, etc.), adapting them to their needs. Copyrights that do not allow derivatives force teachers to choose between not using them at all or infringing the copyright if they want to translate them or mix and reuse. It is therefore recommended to use copyright allowing derivatives if your materials are targeted at teachers.

V. INFORMING POLICY MAKERS

European projects on STEM are opportunities that could be captured both locally and at European level. Projects should take better care of sustainability. To do this it would be beneficial to connect the national programmes to European ones more fruitfully.

Policy makers can better use the outputs of STEM projects, if these connections are made and presented to them. This way they will be able to rely on preformed networks and partnerships. Another step which is very important for policy makers is to show evidence that those results are effective and show practices in which teachers and end-users have employed them.

Remember that policy makers need to account for what they do so this “accountability” approach is much appreciated by them. Since projects are generally not equipped to assess their effectiveness on a large scale in terms of real transformations induced, gathering data on this issue can make the difference. Policy makers reported, both in questionnaires and in discussion events, concentrating on results that showed usability by teachers.

Proposals for innovation are taken into account and possibly supported by policy makers only if they resonate with the practice of teaching and if they impress with the quality and the opportunity for professional development. Then the results can become the basis for further projects or for designing new policies and measures.

VI. INFORMING PROJECT MANAGERS

Some project managers emphasize the need for structuring teacher professional development in Europe by introducing knowledge on practices and methods from European projects into teacher development programmes across Europe.

It is considered that such an ideal structure is more likely to have an impact on teaching practices. Still, such an initiative requires support from funding institutions and a strategy for developing such structures in connection with the projects. Therefore, keep in contact with local teacher trainers, researchers and professors who have a role in professional development and let them know how your project outcomes can contribute to their training tasks.

A good measure to promote the exploitation of results among project managers is to support them to facilitate their use of your outcomes. If you cannot contact any other project manager, provide different mechanisms and supporters who can have this role. For instance, try to involve most partners of the project and colleagues and configure new virtual or face-to-face communities involving new professionals, where you all share resources, report and discuss your experience and recommend and test how to make your outcomes adaptable to other situations.

Developing materials and making them accessible is just the first step. You should also remain involved in making sure your outcomes are understood, tested and discussed by other project managers, researchers and teacher trainers. This is the second and crucial step to give these outcomes the chance to be used in the classroom.

The establishment of these groups of professionals working together not only means they can support each other but should allow them to evolve in such a way that they get some input from the project and then take it further by themselves, sharing ideas, developing ideas, with an initial push from the project, but then in a way which is not dependent on the project.

²⁸ Creative Commons is a nonprofit organisation that enables the sharing and use of creativity and knowledge through free legal tools: <http://creativecommons.org/>

Chapter 3. How can you as stakeholder make a difference?

How can you as STEM education stakeholder make a difference and be a role model?

True role models are those who possess the qualities that we would like to have and those who have affected us in a way that makes us want to be better as persons or in our professional life. We often don't recognize our true role models until we have noticed our own personal growth and progress.

Take leadership on the issues that you believe in as a stakeholder in STEM Education in Europe. You can be a role model when you have a clear view on the goals you want to achieve and the ideals you want to advocate. In this chapter you can find information on how you can advocate innovative STEM practices and methods in European school systems.

I. THE STEM TEACHER WHO CAN MAKE A DIFFERENCE

As a teacher of STEM you are in pole position to encourage and intellectually stimulate more young students in STEM studies and careers. You have a key role in helping them find interest in STEM subjects. Learning more about new methods and teaching materials that can foster changes in student attitudes and achievement can help achieve this goal.

DESIRE identified three main challenges innovative teachers face and the ways they cope with them.

1. Stay informed

Innovative teachers highlight the importance of staying informed about new teaching methods and practices by participating in European and national STEM education projects.²⁹ You will benefit from the experience of project managers and science communicators in the driving seat of these initiatives.

You can also find online portals that give access to information on a wide range of resources and to discussion in online communities including: eTwinning,³⁰ Scientix,³¹ inGenious³² and the Learning Resource Exchange platform.³³ Being active in online communities organised around a specific topic of interest to you is a great way to exchange, create and share ideas online. Moodle³⁴ and Edmodo³⁵ are recognised by many teachers as ideal tools as they are controlled, secured and closed online areas. Pearltrees³⁶ or Diigo³⁷ are facilitators that help teachers connect and share resources and save links and explanations.

Attending face-to-face training can have a long-lasting impact on your teaching and make you more confident in using new approaches in class. Among colleagues you can divide attendance at events among you, making sure you all profit from the opportunities to get inspired. Share the knowledge gained among you by debriefing colleagues on return.

2. Inspire and involve colleagues

Being an innovative teacher also means that you can encourage teacher colleagues to get interested in new ways of teaching STEM subjects. However, many teacher colleagues consider learning about new teaching materials and methods supplementary work that does not fit in with their many duties.

You can inspire colleagues by bringing out the advantages of participation in STEM education projects. They are more likely to try new methods and resources if they realise it will reinforce their STEM teaching skills. But also involving your head teacher is key. For instance with his/her support you could create contests to motivate your colleagues to do school projects in STEM subjects. This will give professional and social recognition to the efforts invested to keep updated on STEM education research results.

3. Manage time constraints

The lack of time is a major challenge. All teachers need to spend time preparing their students for exams. Think about the long term vision you have for your classes. Remember that most newly developed methods and tools to teach STEM subjects often have the objective to make STEM teaching more efficient. Often you can gain time and save efforts in teaching your curricula when applying newly

²⁹ Subscribe to European Schoolnet newsletters to be informed of opportunities to participate in education projects – www.eun.org

³⁰ See: <http://etwinning.net> for more information on this learning community promoting school collaboration and teacher professional development.

³¹ For more information on Scientix, see <http://www.scientix.eu>

³² For more information on inGenious, see <http://www.ingenious-science.eu>

³³ See: <http://lreforschools.eun.org> for more information on Learning Resources Exchange for schools, a service that enables schools to find educational content from many different countries and providers.

³⁴ See: <https://moodle.org/> for more information on this virtual learning environment and social community for teachers

³⁵ See: <http://www.edmodo.com/about> for more information on **edmodo**, the social learning platform for teachers, students, and parents.

³⁶ See: <http://www.pearltrees.com> for more information on this tool acting as an extension of the Internet browser to reference the favourite web pages.

³⁷ See: <https://www.diigo.com/> for more information about this research tool and knowledge-sharing community.

developed methods and tools, once you are familiar with using them.

II. THE PROJECT MANAGER WHO CAN MAKE A DIFFERENCE

As project manager, researcher or teacher trainer in STEM education, you play an important role in spreading the word of on-going projects to teachers who can benefit from project knowledge and results in their educational practice. You might even be a teacher yourself or have a background in school teaching. Take advantage of this knowledge and your established connections with teachers: it will help you to better support them towards changing or adapting their practice.

As a project manager in the field of STEM education you need to take the responsibility not only to disseminate your results through traditional channels (such as scientific journals) but also to reach the final users and beneficiaries of your results. This is a challenge but, at the same time, the best way to bridge the gap between research and practice.

DESIRE identified three recommendations identified by project managers to ensure good dissemination and communication on projects in the STEM education sector.

1. Be well connected

Whether you work freelance or within an institution, you probably have lots of contacts working in related areas with whom you might have collaborated with at some point during your career. Keep in contact with them while being open to integrating new related networks. STEM education is a relatively young knowledge area in many contexts for which new research groups are being formed frequently and they are often a good opportunity to grow and extend your network. Focus on map associations, centres, business, channels and individuals who might be interested in your productions, and bear them in mind when planning your dissemination.

Well-established networks and associations usually manage their own events, newsletters and initiatives such as “Special Interest Groups”. It is advisable to be connected to these networks at the same time as you keep your eyes open to new projects’ outcomes and possible interactions in related areas of interest.

2. Influence on your nearest circles

If you have the chance to establish or participate in local committees, groups or associations, let their participants know what you know. Don’t hesitate to share your expertise, knowledge and resources with them while trying to incorporate and share good resources that you know about from training courses or informal communication with colleagues.

3. Test project outcomes by yourself and provide feedback to developers

You also might prepare pre-service or in-service teacher training courses. If this is the case, test new resources and outcomes that you have produced or that you can adapt from other projects. It would be a desirable practice that you give feedback and recommendations based on your experience on the resources to the original producers and inventors. Your comments are still valuable even if the project is closed, because your reflections and feedback can be taken into consideration in future projects and research. These interactions are a contribution to creating a culture where project managers in STEM education more informally and frequently discuss new points of view and exchange knowledge that will enrich future projects and outcomes. Wouldn’t you like to receive this kind of feedback?

III. THE POLICY MAKER WHO CAN MAKE A DIFFERENCE

You as a policy maker have an important role in the processes of disseminating and exploiting project results. In fact, after a project has finished, the consortium has no more constraints on this part and the majority of the projects results are used less or forgotten. This is of course a waste of time and money and a missed opportunity for the schools that can benefit from the outputs, the findings and the networks developed by a STEM project.

DESIRE identified three main recommendations for innovative policy makers who wish to make a difference in STEM education.

Being a policy maker implies taking responsibility for actions and money being spent. Policy makers know they can have a great part in this process, during the project and after it ends.

1. Be sure you know enough

Study the project outcomes or have an advisor (researcher or expert) identify interesting and successful STEM education products or communities supported by your political entities. This way you have a good overview of the development, progress and success of different projects you can further support. Following the development of projects and their development of evidence, case studies and real practices is a feasible way to get an understanding of the degree of “usability” of a project’s results.

In order to deepen your understanding of the funded projects, keep in contact with the project managers and ask them to provide you evidence on the projects usability and success in the classroom in case you cannot find it in the project documentation. You could occasionally also ask end-users about their experience and the lessons learned.

2. Support projects that can make a difference

If you think some project outcomes are worth disseminating, spread the word on their success and usability in your network. Being a policy maker, you probably meet many people, attend many conferences and make press releases. This gives you great opportunities to network similar initiatives and projects.

If possible look for ways to structure support to valuable project outcomes, by setting up funding for extension of the successful projects, especially for better dissemination and experimentation etc. or by financing initiatives concerning the creation of dissemination gateways on thematic issues (for instance a portal on STEM projects that could include the results of several similar projects, both at a national and international level).

3. Give good project a second life

Use good project outcomes as a basis for further educational measures and initiatives. You can include good results in a fruitful loop by writing notes and referencing them as best practices and include them in the flow of examples you bring up, thus enabling them to have a second life.

IV. THE SCIENCE MUSEUM PROFESSIONAL WHO CAN MAKE A DIFFERENCE

You are a science museum professional. This means you are probably overwhelmed by regular science activities, special projects and administrative tasks. You are part of an institution which can support you but you have rules and an identity to respect. However, you can be one of the professionals who constantly learn about new approaches, constantly try them out, and slowly forge the institution's identity.

DESIRE identified three main recommendations for innovative science museum professionals who wish to make a difference in STEM education.

1. Have big ears and eyes

A science museum is a science education laboratory, so take time to watch out for your results: what worked one year ago may not work today. Communicate your issues and needs to colleagues: someone may have heard about a solution for you! What are other people interested in?

Look outside your institution: remember that other institutions', other teams' and other countries' attempts can be very inspiring. They will help you spot the latest trends in the field. Many new and original attempts are being made around you. Many of them will not be successful: keep listening though! Multiple failures lead to successful achievements. Through your network of colleagues, social media and specific events, you can keep up to date with what is being built in science education in Europe.

Participate in multiple events: conferences, teacher workshops, events in other institutions. Meet people physically: the Internet cannot replace the quality of direct interactions.

2. Spot and test

Can you spot the most interesting practices? You need good intuition on what is relevant for your institution, and what is worth trying out. Find out how you can integrate a little piece of innovative approach in a regular activity. Test what you hear about on a small scale, notice what works and what doesn't, look for improvement, and slowly seek to implement new successful practices in your science museum.

Use your institution as a shelter to securely try out daring innovative approaches that could not be attempted by a freelancer – who would put his contracts at risk – or by a teacher – who has curriculum constraints. Once again, be aware that multiple failures are usually necessary to build new approaches. Take risks and find the right balance between innovative try-outs and reliable practices. Also don't be afraid of adjusting new resources by adding your personal touch! Modify it until it looks as if it has been created specifically for your science centre or museum.

3. Have a big mouth

Relay information! You heard about a new attempt, attended a good event, read an article on science education materials? Tell everyone about it orally and digitally and position yourself as an information supplier. Though physical interactions are the most valuable, newsletters and social media are a great way to quickly update other science education professionals who don't have much time. As the information from science education projects is sometimes scattered, information relays are precious assets in a network. If you use a social media account, make it clear: is it for institutional communication or is it a sort of "peer-to-peer" group? In the first case, the author is the institution, so there is not two-way communication but a broadcast-like one. In the second case, conversation and feedback are the qualifying elements.

Then, report on what you tried and share your experiences – including the bad ones. There is always a temptation to present only successes: a good analysis of something that did not work out is often also useful and educative. And don't limit yourself to the science communicators' community! Communicate with project managers, researcher, teachers and teacher trainers, even policy makers.

V. THE SCIENCE EVENT ORGANISER WHO CAN MAKE A DIFFERENCE

As a science event organiser, you engage children, teachers, schools, and families to learn about science and science education in different events. Science events come in various formats like science festivals, researchers' nights, conferences, science cafés, children's universities and much more. Two-way science communication is the focus of these activities and the main objective is to facilitate the necessary dialogue between science and society. Science event organisers can therefore advantageously be involved as partners in projects, as they play an important part when results from science and science education projects need to be communicated to other stakeholders.

DESIRE identified three main recommendations for innovative science event organisers who wish to make a difference in STEM education.

1. Listen to your target groups

Even though you may have a long list of experience with science communication, audience preferences and interests change over time. Therefore be open to listen to your audience and observe new needs. Do you detect any needs that you as a science communicator can fulfil?

2. Prioritise your dissemination strategy and keep it flexible

Allocate money in your budget to creating media productions to get media attention. This seems by far to be the best way to draw attention to your project.

Depending on the project and the budget, it is always a good idea to publish your project in different ways. You can make a book or booklet, write an article and spread it through relevant journals and magazines, but remember to combine a publication with different activities that will give your audience a reason to read the book. Have teachers or other relevant stakeholders recommend the publication. This will help secure trust in the project and the project results – and a better chance that these new findings will be implemented in future science education and communication.

A successful event requires successful dissemination strategies. And it is important you already think of the dissemination of results from the infancy of the project. Planning your dissemination is crucial, but also remember to evaluate your efforts continuously to make sure that the dissemination activities you are performing are actually relevant to reaching your target group. If specific efforts do not seem to work – change them!

3. Ambassadors - training and face-to-face activities

It is important to teach and train “ambassadors” who can help spread the message of your project. It's an efficient way of reaching many people via face-to-face communication. When your audience meet the dedicated people behind the project, trust grows – and your network grows. The ambassadors will be involved and will help spread the message of your project.

When you meet face-to-face, you have a real chance of changing the participants' perceptions. Conferences, workshops and seminars are great formats to get the attention of your target group – remember: two minutes in person will help people remember a project better than a thousand newsletters or websites.

Conclusions

Now that you have been through this Reach Out Toolkit and learned about the DESIRE project recommendations, we hope you are better prepared to address the dissemination and exploitation challenges of your STEM education projects.

The DESIRE project results and recommendations have been based on data provided by stakeholders involved in 31 different national and European STEM education projects. The results were collected from a survey and discussion events.

The stakeholders represented in the DESIRE project were project managers, teachers, policy makers, science event organisers and science centres and museums professionals.

One of the main findings of the DESIRE project is that most of the **models of dissemination currently used** in funded projects on STEM education seem to combine channels and strategies characteristic of **traditional linear models** and **social constructivist models** (e.g. wide use of reports, websites and conferences as dissemination channels, face-to-face participatory techniques to interact with stakeholders).

Recommendations from stakeholders we questioned and discussed with tend to advocate dissemination models which assume wider involvement of stakeholders and already existing institutions and networks as intermediaries with an active role in dissemination actions, which is characteristic of the **sustained interactivity model**.

At the same time, stakeholders recommend taking account of contextual factors influencing dissemination, stressing the need to overcome language barriers, to align the outcomes with curriculum, school organization, and teachers' current practices, to organise local consulting commissions, etc. These recommendations are also consistent with the **Mode 2 knowledge model**.

The Reach Out Toolkit proposed three main chapters: the first one tackles the dissemination of results, the second one the exploitation strategies and the last one the question of making a difference as a stakeholder in STEM education.

In the dissemination chapter we proposed recommendations to reach teachers, project managers, policy makers and science event organisers and professionals from science centres.

In terms of dissemination to reach **teachers**, we recommend that:

- ▶ You make sure your strategy is participatory from the design phase to make sure it is oriented towards the teacher's needs. You should continue also involving the teachers in the dissemination actions. They are the best actors to engage more teachers and show that innovating and using new STEM teaching practices is possible.
- ▶ When designing and implementing your dissemination strategy, it is fundamental to know your target. This should be done by analysing the working context, the STEM curricula of the country involved, and by taking into account the constraints linked to time and resources that teachers face.
- ▶ When spreading your project results, keep in mind you should tell a story and convince teachers your project results are easy to use. Teachers like to be approached with teaching materials covering different topics strongly connected to real life.
- ▶ In terms of channels used, don't forget to include local or regional dissemination activities and allocate resources to face-to-face activities which ensure better appropriation of your results by the teachers. Do not neglect social media that are massively used by teachers, especially secured ones like Moodle.

- ▶ Be brief and smart, as teachers are busy and already fighting with their curriculum programme and extra-curricular activities; they do not have much time to devote to the search for your results.
- ▶ When designing your website, create a specific section for teachers, create a simple navigation and avoid institutional jargon. You can also involve teachers to make a user needs analysis.
- ▶ Above all, the most important thing is to combine dissemination channels. Teachers benefit more from the innovation resulting from STEM education projects if online dissemination channels and face-to-face events are combined. Keep in mind the incentives that help teachers to find a motivation for your new practices. You should foster professional development opportunities, equipment for schools, social and professional recognition.

In terms of dissemination from project managers to **project managers**, we recommend that you:

- ▶ Think of your own needs as a stakeholder and you will be closer to other project managers' needs
- ▶ Bear in mind that project managers and researchers in STEM education might be interested in knowing your research studies' findings as well as your innovative resources, networks, materials or practices
- ▶ Balance the types of outcomes you produce in order to attune them to project outcomes expected (by stakeholders)
- ▶ Tell project managers about your research experience and spread good practice generating adaptive and supportive processes
- ▶ Frequent and disseminate through traditional events on STEM education that project managers usually attend
- ▶ Break old habits and investigate new communication channels occasionally: it leads to new networks and information
- ▶ Give space to random dissemination by using your professional network informally and be open to adapting your strategies to each context
- ▶ Reach out beyond your network by making use of superconductive people who can function as your national ambassadors or intermediaries in dissemination
- ▶ Communicate different messages to project managers throughout the lifetime of a project and even beyond using already existing networks, portals or new initiatives

Approaching the question of dissemination of STEM education project results without tackling the challenge of reaching **policy makers (or their advisors)** would not be sustainable. This is the reason why we invite you to consider this question with a few recommendations. To better reach out to advisors of policy makers we recommend that you:

- ▶ Target policy makers' advisory boards, which are made up of specialists who advise them.
- ▶ Communicate through brief documents like flyers or short project report versions. Keep on using the Internet as the main gate to information. Face-to-face means of dissemination, like traditional fairs, conferences, and seminars, are the most used official routes for policy makers to get informed.
- ▶ But most importantly use and expand your policy network. 91% of the questioned policy makers mentioned that their main information source is people in their network.
- ▶ Policy makers prefer to be informed about teaching and learning material, repositories of resources and practices but also about networking establishments as a result of project efforts. Recommendations and good practice are also considered useful information.
- ▶ Some of the successful strategies mentioned by policy makers relate to the fact of being involved and informed at an early stage and having the time to become familiar with the project. They also appreciate having access to information in their native language.

- ▶ Use policy makers to disseminate your project.

The last element we have analysed in the dissemination chapter is how to reach science event organisers and professionals from science museums and science centres. In this section, we recommend using:

- ▶ Newsletters and articles specifically targeted at science communicators in networks active in that field
- ▶ National and European network channels
- ▶ Physical events, where science communicators can meet the project team
- ▶ Science festivals and informal education events
- ▶ Partnership with some major science centres to relay towards other smaller centres
- ▶ Websites specifically built for informal learning research, widely used in the science communication community
- ▶ Broad and transversal topics
- ▶ Dissemination strategies that suggest several ways to use the materials, are adaptable to different situations and are presented as an inspirational tool fostering users and local content

The second big chapter of this Reach Out Toolkit refers to exploitation strategy. In this chapter we did not propose strategies differentiated according to the profile of your target. We described general methods and recommendations that were reported by the various stakeholders who took part in the discussion events. We recommended **adapting to the target needs and desires** of users using method(s) to gather feedback:

- ▶ User need analysis to start your project on the right foot
- ▶ Pilot phase to make your target group validate your resources before scaling-up
- ▶ Focus group, workshops, interviews or online discussion events to get in-depth feedback on your results
- ▶ Survey to get a wider number of stakeholders providing feedback

We then explain that exploitation also implies empowering users in various ways:

- ▶ Provide adaptable results
- ▶ Create supporting documents or videos to accompany your results
- ▶ Help your stakeholders with theoretical background and practical activities
- ▶ Organise training activities

Exploiting your results also means that you should make them **sustainable** and think of the period after the end of the project.

Finally remember that each stakeholder can make a difference in adapting behaviours regarding the dissemination and exploitation of results and being active in looking for innovative and up-to-date practices, methods and resources. The **third big chapter proposed some ideas and practical advice to make a difference** as STEM teacher, project manager, policy maker and science museum professional.

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Hughes, C. (2003). Models of dissemination. In C. Hughes (Ed.), *Disseminating Qualitative Research in Educational Settings* (1st edition, pp. 24–40). Glasgow: Open University Press. Retrieved from <http://books.google.es/books?hl=es&lr=&id=8Iz3i1755FUC&oi=fnd&pg=PR1&dq=Disseminating+Qualitative+Research+in+Educational+Settings&ots=cXmpE24bon&sig=H88PpmFOqqvb7JrjBhGw4Kecq7I>

Hutchinson, J. R. and M. Huberman (1994). Knowledge Dissemination and Use in Science and Mathematics Education: A Literature Review. *Journal of Science Education and Technology*, 3(1): 27-47.

National Center for the Dissemination of Disability Research – NCDDR (2001). *Developing an Effective Dissemination Plan*. Southwest Educational Development Laboratory

Rogers, E.M. (2003). *Diffusion of Innovations*. 5th Edition. New York: The Free Press.

Saywell, D., Cotton, A., & Woodfield, J. (1999). *Spreading the Word: Disseminating Research Findings*. Synthesis note. Leicestershire, UK.

Other publications

Here are a number of additional publications on dissemination of project results not specifically related to STEM education that can be useful for general considerations:

Survival kit for LLP projects: <http://www.european-project-management.eu/index.php>

Making waves: <http://www.salto-youth.net/rc/inclusion/inclusionpublications/inclusionforall/makingwaves/>

A scientist's survival kit: http://ec.europa.eu/research/science-society/pdf/communicating-science_en.pdf

Communicating EU research & innovation: http://ec.europa.eu/research/social-sciences/pdf/communicating-research_en.pdf

Seeing is Believing, Resource Media's new best practices guide on visual storytelling, gives you the latest research and tools to address this communications blind spot. <http://www.resource-media.org/wp-content/uploads/2013/04/Visual-storytelling-guide.pdf>

Dissemination and exploitation of results of programmes of DG Education and Culture - Intellectual property rights: http://ec.europa.eu/dgs/education_culture/valorisation/ipr_en.htm

List of projects

This is the list of projects about which Project Managers provided information through questionnaire:

Projects funded by the European Commission (7th Framework Programme):

Engineer - <http://www.engineer-project.eu/>
Establish - <http://www.establish-fp7.eu/>
Fibonacci - <http://www.fibonacciproject.eu>
Ingenious – ECB - <http://www.ingenious-science.eu/>
Inquire - <http://www.inquirebotany.org/>
Iris – [http:// iris.fp-7.org](http://iris.fp-7.org)
Nanochannels - <http://www.nanochannelsfp7.eu/>
Nanoyou - <http://nanoyou.eu/>
Pathway - <http://www.pathwayproject.eu>
Sails - <http://www.sails-project.eu/portal>
Scientix - <http://www.scientix.eu/>
Sed - <http://science-education-for-diversity.eu/>
S-team - <https://www.ntnu.no>
Twist - <http://www.the-twist-project.eu/en/>
U4Energy - <http://u4energy.eu/>
Xplore Health - <http://www.xplorehealth.eu>

Projects funded by the Education, Audiovisual and Culture Executive Agency (Lifelong Learning Programme)

Comblab – not available
CrossNet - <http://www.crossnet.unikiel.de/cms/>
eTwinning - <http://www.etwinning.net/>
EU Train - http://www.helsinki.fi/luma/eutrain/outputs/dissemination/article_npp_208_1.pdf
Feast - <http://feastportal.wordpress.com/>
Inspire - <http://inspire.eun.org>
Spice - <http://spice.eun.org/web/spice>
Stella - <http://www.stellascience.eu/>
Stencil - <http://www.stencilscience.eu/>
UniSchoolLabS - <http://unischoolabs.eun.org/>

Projects funded by public (national) organizations

Compec (Spain) - <http://www.crecim.cat/portal/index.php/ca-ES/projectes?id=86>
Epse (UK) - <http://www.york.ac.uk/education/research/cirse/older/epse/>
Projekt X (Denmark) - <http://ntsnet.dk/projekt-x>

Projects funded by other institutions

Muse (EPS) - http://www.eps.org/members/group_content_view.asp?group=85190&id=187784

This publication emerges from the DESIRE project, an initiative that developed a set of recommendations and identified best practices to ease the spreading of STEM education projects results. The main aim is to provide insights and guidance to better disseminate and exploit these results mainly to teachers but also to the various stakeholders involved in formal and informal STEM education projects.

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