Periodic Report Number 2

Project Acronym: ENGAGE

Project Name: Equipping the Next Generation for Active ENGAGEment in Science

Call: SCIENCE IN SOCIETY [2013.3.2.2.1-1]

Project Type: Coordination and support actions

Grant Agreement No.: 612269

Project Start Date: 1st January 2014

Project Duration: 39-Months

Date of latest version of Annex 1 against which the assessment will be made:

Period covered: from: 01/09/2015 to: 31/03/2017

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THE ENGAGE CONSORTIUM

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Knowledge Media Institute – The Open University	UK
Institute of Applied and Computational Mathematics, Foundation for Research and Technology	Greece
Innovation in Learning Institute	Germany
eXact learning Solutions	Italy
Traces	France
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Weizmann Institute	Israel
Universitat de Barcelona	Spain
Buskerud and Vestfold University College	Norway
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School of High Pedagogy of Freiburg	Switzerland
Lithuanian University of Educational Sciences	Lithuania
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1. DECLARATION

Declaration by the scientific representative of the project coordinator

I, as scientific representative of the coordinator of this project and in line with the obligations as stated in Article II.2.3 of the Grant Agreement declare that:

- The attached periodic report represents an accurate description of the work carried out in this project for this reporting period;
- The project (tick as appropriate) [1]:

    has achieved most of its objectives and technical goals for the period with relatively minor deviations.

- The public website, if applicable

    is up to date

- To my best knowledge, the financial statements which are being submitted as part of this report are in line with the actual work carried out and are consistent with the report on the resources used for the project (section 3.4) and if applicable with the certificate on financial statement.
- All beneficiaries, in particular non-profit public bodies, secondary and higher education establishments, research organisations and SMEs, have declared to have verified their legal status. Any changes have been reported under section 3.2.3 (Project Management) in accordance with Article II.3.f of the Grant Agreement.

Name of scientific representative of the Coordinator: . **Tony Sherborne**

Date: .....14....../ ...06......./ ....2017.......

For most of the projects, the signature of this declaration could be done directly via the IT reporting tool through an adapted IT mechanism and in that case, no signed paper form needs to be sent

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[1] If either of these boxes below is ticked, the report should reflect these and any remedial actions taken.

1. PUBLISHABLE SUMMARY

1.1 The ENGAGE project

Shifting school science towards RRI

ENGAGE is aimed to give the next generation of students the knowledge, skills and attitudes to deal with socio-scientific issues in their lives, and develop informed opinions on emerging science and technology. ENGAGE's goal is to embed Responsible Research and Innovation (RRI) within the science curriculum and change the way science is taught. Through a set of innovative strategies, we have attempted to shift the emphasis from transmitting a body of scientific knowledge towards applying science to issues that matter to students. At the heart of ENGAGE is using authentic activities to simulate how citizens conduct inquiries. ENGAGE operates on a major scale. More than 15,000 teachers have signed up across 11 partner countries: UK. Greece, Germany, France, Romania, Israel, Spain, Norway, Switzerland, Lithuania, and Cyprus.

State of the art innovation

Teachers need make major changes in practice to use socio-scientific issues in the classroom. Therefore ENGAGE chose a thought-out, multi-pronged approach and created a series of positive conditions for change. We created high-quality lessons that would encourage RRI-based teaching through effective engagement. We also constructed an escalated step pathway of progression in teaching skills load to foster teacher change - In the ENGAGE model, once teachers gain confidence with the intuitive ADOPT teaching approaches, a proportion progress to using more advanced ADAPT materials in the next stage. This second stage involves a deeper interest and commitment to the ENGAGE philosophy, because the materials demand more curriculum time to explicitly teach RRI skills. The third step, called TRANSFORM, is our experiment in project-based learning. It was designed for a small proportion of teachers who wanted to make RRI and socio-scientific issues a major focus of their curriculum enhancement. We provided support to help them plan an issue-based project where students could engage in more autonomous and extended enquiry, and interact with practising scientists.

ENGAGE used an approach to materials that utilises science issues from the news into fully realised and resourced lessons. These help teachers use often unfamiliar teaching approaches, based on an already popular model: a tried and tested, resource-led approach, which was led in the UK.

The programme is supported by three key strategies that take a funnel approach to involvement, with more teachers at the ADOPT phase and fewer reaching the TRANSFORM phase, but those that do having a deeper involvement.

1) The first step, ADOPT, has a very accessible and attractive entry point to achieve take-up on a large scale.

2) For teachers who were curious to find out why the lessons worked, we developed workshops and online courses to teach the tools for using the materials effectively.

3) We set up an online community to stimulate reflective dialogue and interaction with more knowledgeable mentors.

The Phases of ENGAGE

Topicals (ADOPT): 22 of these 'entry-level' activities were developed, where students apply science knowledge and enquiry /RRI skills to a socio-scientific dilemma. This is more than the 20 we expected in the DoW. Topicals were very important to our strategy, and publishing them regularly throughout the project has enabled us to build a large user base.

Sequences (ADAPT): 12 of these 'advanced level' activities were developed, which explicitly teach students enquiry/RRI skills Sequences using games, and then apply these to solve a socio-scientific Dilemma. In the DoW, we expected to produce 20. The reason for developing fewer activities is that it proved much more complex and time-consuming than anticipated to create a Sequence that teachers would find sufficiently valuable to give 2 lessons of curriculum time for. Therefore we put more effort into creating a smaller number of Sequences to ensure their quality and uptake, which has been high.

Projects (TRANSFORM): A total of 16 extended enquiries into socio-scientific issues were developed, to enable students to work more autonomously using RRI skills. Two of these 'global projects' were developed by the WP3 team at SHU, to act as exemplars. These were translated by each partner. Additionally, each partner developed one or two of their own projects: a 'local project' customised for an issue relevant to their country. In the DoW we expected to develop up to 20 projects. As with Sequences, we found that development of high quality, project-based learning that would be useful to teachers across all countries was a complex and time-intensive process. Therefore we decided to limit production to the numbers above. Downloads of the global projects have been high and comments very favourable, justifying the emphasis on quality over quantity.

1.2 ENGAGE Achievement

Award for best Open Educational Resources
ENGAGE materials have become used and respected by teachers for their quality, student engagement and learning potential. We are proud to have been a winner of a 2017 OER & Project Award for Open Education Excellence. This award was given to ENGAGE for our curriculum materials, and was recognition of our novel approach to teaching young people science through the theme of Responsible Research and Innovation. The award was presented at the OEC Global Conference in Cape Town, South Africa in March 2017. The image shows the team celebrating at our final Consortium Meeting. The quality of ENGAGE materials was further recognised by the Association of Lithuanian Science Teachers, who judged ENGAGE to be the best project in 2015.

Uptake of materials
Since the ENGAGE website was launched in June 2015, more than 15,000 teachers have signed up across 11 partner countries. Some partners, Lithuania, Israel and UK, exceeded their ambitious targets for engaging teachers. The materials have together been downloaded more than 200,000 times. Evaluation based on surveys of teachers who downloaded the materials indicates that so far about 5,000 teachers have become actual users. Almost all teachers' views about the materials posted online have supported the idea that they create positive experiences in the classroom.

Thought-out approach to curriculum and professional development
With the aim of ENGAGE being to get an RRI approach embedded in schools, the first step was to clearly link the approach with national curricula and assessment. This was done by integrating RRI with the 'scientific inquiry' skills that have been recognised as being a key approach to engaging students in science. ENGAGE prioritised a set of 10 processes which became the learning objectives of the curriculum materials: define questions, analyse patterns, draw conclusions, communicate ideas, justify opinions, critique claims, interrogate sources, use ethics, estimate risks, and examine consequences. Secondly, ENGAGE's novel strategies for teaching RRI were developed into a set of 'Tools', and the professional development programme was centred around coaching teachers in the use of these in the classroom. Six of these tools were developed: Dilemma Lessons, Problem-solving Sequences, Scenario-based Topics, Group Discussions, Class Conversations, and Performance Assessment. Based on this professional development framework, we created online Massive Open Online Course (MOOC)-styled courses for each project stage (ADOPT, ADAPT and TRANSFORM), and delivered 25 courses across 11 countries. Our partners also rolled out dozens of workshops that engaged over 1200 teachers.

1.3 The impact of ENGAGE

Lots of ENGAGE users in some countries

The extent of take-up of ENGAGE materials has been substantial. In Lithuania, 16% of all science teachers are estimated to have used ENGAGE. In the UK, a third of all science teachers have registered and more than 10% have so far used the materials, based on survey data. These numbers indicate that there are a good number of teachers who, because of their positive experiences, are likely to spread ENGAGE by word of mouth so that the number of users continues to rise.

Effective online courses and workshops

The ENGAGE online courses were a localised success in some countries getting teachers to use the materials, and to reflect on the pedagogies of teaching with RRI. However, in other countries it proved difficult to replicate the success, often falling down at the recruitment of teacher stage. Around two-thirds of teachers participating reported that they learned strategies for developing students' inquiry skills to a high extent, and half the teachers said they learned how to structure effective discussions. In Greece, in-depth evaluation found a clear positive impact on raising teachers' awareness of RRI in science education. In some countries, workshops were an easier way to get teachers to participate in formal professional development. The internal evaluation found these were also influential in helping teachers gain confidence in using group discussions and dilemmas in science lessons.

Evidence of a shift towards RRI-based teaching

The internal evaluation, carried out by Tu Delft, found evidence that teachers shifted their practice towards RRI-based teaching as a result of involvement in ENGAGE. Using a 5-dimensional model to characterise this shift, and from the statistical analysis, there was strong evidence that ENGAGE could improve teachers' knowledge of RRI (see WP8 report). In the other dimensions, such as teachers' roles and their goals for science teaching, there were only slight increases in the mean values. With limited time to implement the TRANSFORM stage most of the evidence was captured from ADAPT teachers. They had modest experience of ENGAGE compared to the TRANSFORM teachers who had been through the whole programme. A more significant shift in RRI-based teaching may have been found if more TRANSFORM teachers had been surveyed.

In the research into teachers' pedagogical content knowledge (PCK), it was found that using ENGAGE materials enabled some teachers to successfully develop new instructional strategies for addressing socio-scientific issues. The internal evaluator concluded that ENGAGE's materials were sufficiently educative for teachers to learn new strategies for RRI-based teaching without engaging in formal professional development.

Increased student motivation and inquiry skills

The thousands of comments on the website provide anecdotal evidence ENGAGE makes science lessons highly motivating for students. Our external evaluator found some evidence of a positive influence on student engagement from video recordings of two teachers' lessons. When students were experiencing an ENGAGE lesson, their 'time on task' seemed to improve compared to before the lesson. In Romania, the impact of ENGAGE on students' behaviour was studied with 64 students. Anecdotal evidence suggested that after using ENGAGE the majority of students began to read and discuss things related to science and technology more outside of classroom. Each partner also carried out case studies on their teachers' use of ENGAGE, and in all cases using ENGAGE seemed to improve students' inquiry skills. However, in terms of other stakeholders such as scientists, the evaluation was unable to show impact.

1.4 The legacy of ENGAGE

Continuing usage of ENGAGE materials
The ENGAGE website and its collection of curriculum materials is a major legacy for the project. It will be maintained for three years, with 37 high quality curriculum materials in 11 languages to help teachers use socio-scientific issues with their students to develop RRI skills. The materials are backed up by articles and discussion papers for teachers to deepen their knowledge of RRI. In most partner countries, the online course content will continue to be accessible for teachers to participate in a localised way. Based on the 16,000 teachers already registered, and word of mouth, it is hoped that the numbers of downloads, usage and comments will continue even without partners' direct involvement.

Impact on science curriculum policy
ENGAGE was particularly successful in influencing curriculum policy in the UK, working with the largest awarding body (AQA) to incorporate ENGAGE's 'RRI curriculum' into its Science Syllabus for 11-14 year olds. The Syllabus promotes ENGAGE activities as ideal resources towards meeting one of the assessment objectives - to apply knowledge. AQA and other publishers such as Hodder have specifically recommended ENGAGE on their websites, and this will ensure that the materials are used by many teachers as a core part of the curriculum for several years.

Embedding into teacher training
In Cyprus, Romania, Greece and the Netherlands, partners have managed to incorporate ENGAGE into both undergraduate and post-graduate initial teacher training, and Masters courses for teaching and science communication. This includes using specific ENGAGE lessons and 'Tools' for RRI-based teaching within the course programme, so that many new teachers will be exposed to ENGAGE at the beginning of their careers and are likely to integrate the approaches into their teaching.

ENGAGE beyond consortium countries
Based on data of downloads from the website, the use of ENGAGE materials has already spread to 80 countries. In Vietnam, China, Peru, Columbia and Uruguay, there are direct reports of schools taking up ENGAGE and embedding into their curriculum. The largest impact has been in Brazil, where four different cities ran very large projects with schools, using the 'Zika' ENGAGE materials which are of obvious relevance in Brazil. Around 80 teachers and more than 1000 students participated in workshops, and students presented posters at a national exhibition. Equally importantly, the students collaborated with 36 scientists and experts to develop their understanding of RRI.

2. PROJECT OBJECTIVES & ACTIONS UPON RECOMMENDATIONS

2.1 Project Objectives for the period September 2015-March 2017

ENGAGE has delivered the majority its objectives during this second period. It is clear from the individual partner reports that ENGAGE has had impact on science teachers, and some influence on students, and that it is leaving behind a strong legacy. It has been very challenging to develop and roll out three project stages, ADOPT, ADAPT and TRANSFORM, in only three years, across 11 countries. However, both ADOPT and ADAPT achieved their objectives of recruiting large numbers of teachers to try ENGAGE materials, and then get them more committed to RRI by participating in professional development, or using ENGAGE to teach RRI skills as part of their teaching. As a result of the three-month extension, TRANSFORM was delivered in a limited form; however, there was not enough time to embed this fully, meaning that the numbers of teachers who could go through all three stages was limited.

2.2 Actions from review period Jan 2016-March 2017

Following the mid-term review in Brussels in December 2015 our project delivery was revised as shown in tthe later project management report.

Of the components of ENGAGE, the most well-received by teachers have been the materials, with take-up and very positive reports from teachers. There was also some evidence that using the materials alone can shift practice towards RRI-based teaching. The professional development programme reached large numbers of teachers and was well received, and in some cases influenced future practice. The challenge was to get teachers who are under great pressure to deliver the curriculum in school to participate. Ability to tailor and localise CPD was key to success, so short workshops proved most effective in countries such as the UK. Longer online courses have worked very well in countries such as Spain where teachers want ongoing support. Setting up an online community provided the most difficult challenge. Few partners reported evidence of significant discussion between teachers online. Other countries tried to supplement the online community with face-to-face events, which have created a cadre of innovative teachers as part of the project legacy. In this project period, the focus shifted from engaging large numbers of teachers (ADOPT and ADAPT stages of the project) to working more closely and bespokely with individual teachers (the TRANSFORM stage) and collecting qualitative evidence of impact. All partners carried out case studies, and five went beyond this to collaborate on a 'PCK research project' to find out what teachers learned from using ENGAGE. (See final report).

Overall outputs for second period

ADOPT outputs

During months 19-39 we met and exceeded the target for curriculum materials, publishing 22 Topicals in all 11 countries. The total number of users registered in the ENGAGE knowledge Hub reached 16,107, with 10,218 of these having downloaded at least one ADOPT material (download). This number (of downloads) indicates a success rate of 87% on initial targets set in the DoW (see the WP4 report for more detailed information on targets). Evidence on usage of the ADOPT materials in the Knowledge Hub has been provided by more than 1,750 comments published by users. At least two workshops were conducted in each of the 11 countries of the consortium on the dilemma and group discussion teaching strategies, engaging a total of 1,268 teachers: almost double the target of 645 teachers set in the DoW. 25 online courses were delivered in the lifetime of the project in the 11 countries of the consortium, in which a total of 974 teachers enrolled.

It is difficult to estimate the number of students who have used the ENGAGE materials in school. However given the number of downloads and the positive responses to the materials it is estimated that the project will have come close to the targets as specified in the DoW.

ADAPT outputs

ADAPT achieved its aim of getting initial ADOPT users to get more involved in RRI-teaching. From a total of 11,940, 26% moved forward to ADOPT, so they could use the more advanced materials, exceeding targets. During months 19-39, 12 of these advanced materials were developed - 'Sequences'. This was fewer than expected, mainly because it was a difficult challenge to create a design for longer materials that would actually get used by teachers in curriculum time. However it is clear, from the number of downloads and comments, that these were successful. All Partners ran online courses, with 236 teachers completing: about 65% of the target. However this reflects the challenge of getting teachers to commit to non-essential activities that involve out-of-school commitment.

TRANSFORM outputs

For TRANSFORM, a lot of time was invested in creating a format for a 'Project' which teachers would consider of enough value to need several lessons. Two 'Global Projects' were created that were published across the consortium, and individual countries created their own 'Local Projects' based on locally-relevant issues. The total number of downloads for TRANSFORM Projects was more than 3000. Partners worked in a bespoke yet time-heavy way to individually support 42 teachers with their projects. About 150 teachers were involved in online courses, which is very close to the target. About half of the teachers completed the course.

# 3. PROGRESS REPORTS

3.1 Work Package 1 - Framework

This Work Package was led by Weizmann Institute of Science (Israel), and completed by month 8 of the project. The goal of this Work Package was to specify ENGAGE's RRI approach and create the framework for developing the project. The framework will be used to guide development of RRI best practice, innovative materials and CPD, and to make design and development systematic. Deliverable 1 of WP1 was rejected and resubmitted following the mid-term review.
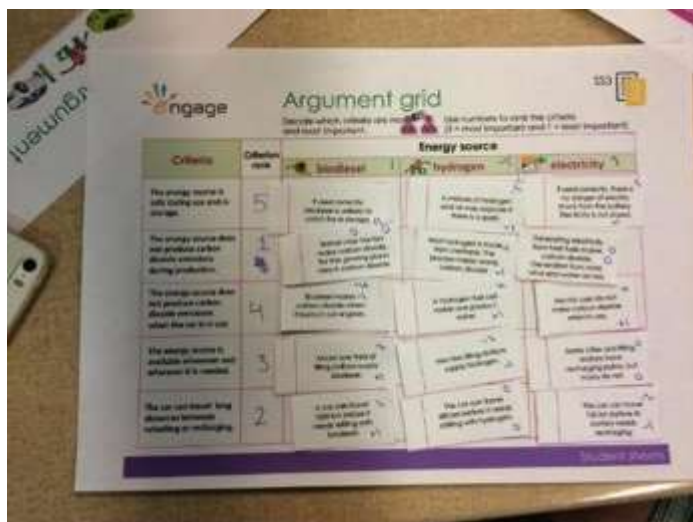
We defined an RRI curriculum which explicitly teaches skills like argumentation; vital for engaging with socio-scientific issues

Objective 1: Specify ENGAGE's RRI approach and interventions

Objective 2: Produce a rigorous RRI curriculum framework
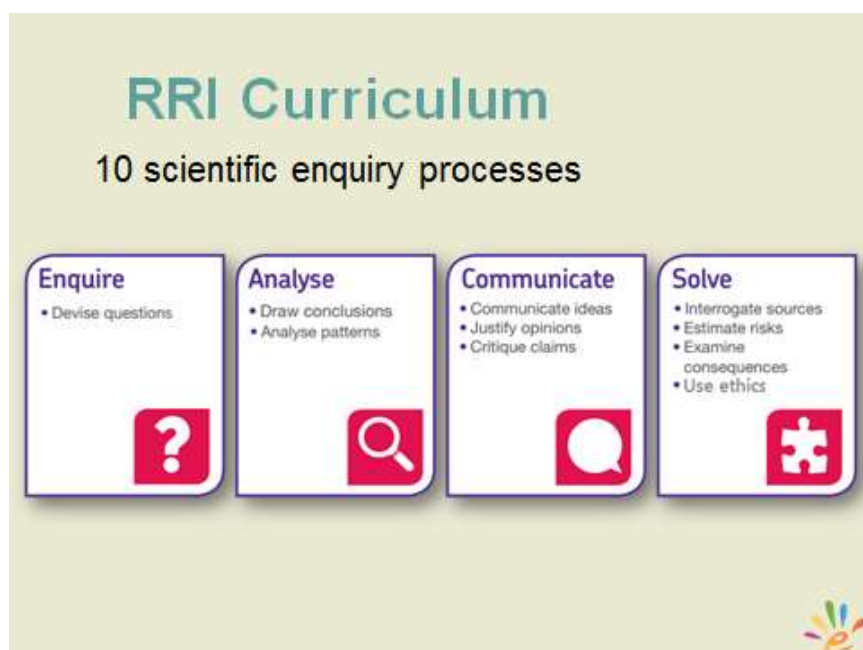
Objective 3: Produce prototype materials

Objective 4: Refine the model of professional development

Materials were tested in UK, Israel, Cyprus and Norway. Observations were conducted only in three out of the four countries.

WP1 produced several significant results:

- A survey on RRI opportunities & challenges in 14 countries (D1.1)
- A framework for developing materials - the main design principle is combining scientific ideas with RRI goals and RRI practices, strategies and specified outcomes.
- A framework and materials for ADOPT CPD courses (D1.2)

Resources

Following the mid-term review aspects of this work package were revised to better reflect ENGAGE within terms of its RRI context. This resulted in additional investment of resource beyond that originally planned for.

Partner	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
	SHU	OU	FORTH	FAU	ELS	TRACES	VUT	WEIZMAN	UB	HSN	TU Delf	DICS	LIETUVO	Unic	
Person months - Total for the Project (annex1)	2.5	2.5	3.5	1	0	1.5	0	4	0	2	0	0.5	0	2	19.5
Estimated for the 1st 18 months	1.25	1.25	1.75	0.50	0.00	0.75	0.00	2.00	0.00	1.00	0.00	0.25	0	1.00	9.75
Actual for the 1st 18 months	3.2	2.2	3.5	1	0	0.5	0	2.85	0	1.3	0	0.5	0.00	1	16.05
Estimated for months 19-39	1.25	1.25	1.75	0.50	0.00	0.75	0.00	2.00	0.00	1.00	0.00	0.25	0.00	1.00	9.75
Actual for months 19-39	0.9	0	0	0	0	1	0	2	0	0	0	0	0.00	1	4.9

3.2 Work Package 2 - Knowledge Hub

This Work Package was led by ELS (Lattanzio Learning). The goal of WP2 was to create effective platforms to deliver to teachers the three project strategies: curriculum materials, online courses and community.

WP2 produced several significant results:

- Set-up, tailoring and customisation of the training platform in nine languages for 11 countries, supporting more than 13,000 registered users in 130,000 downloads

- Set-up and maintenance of a special section, providing news about project activities and achievements

FIGURE 1: OVERVIEW OF PLATFORM UPDATES & EXTENSIONS IN THE 2ND PERIOD OF THE PROJECT

- Set-up, integration and maintenance of a MOOC (massive open online course) platform, supporting 10 MOOCs in one year with 400 registered users
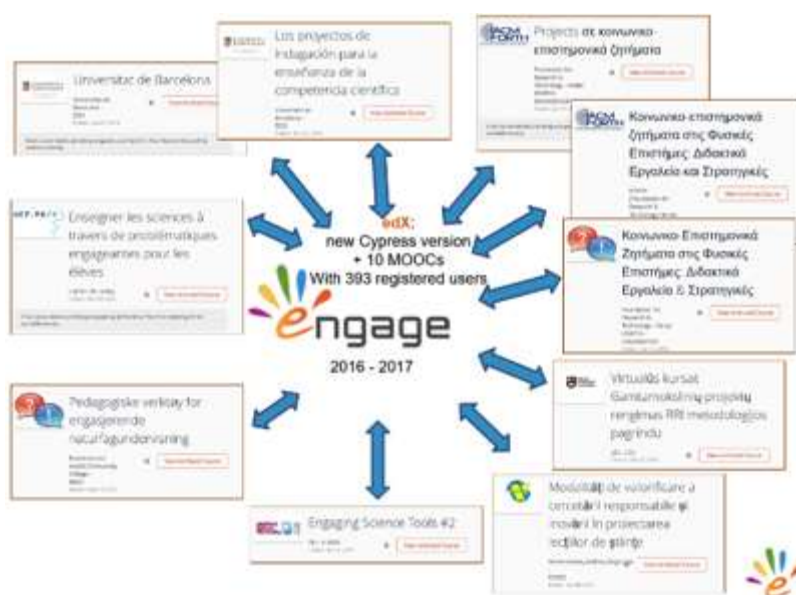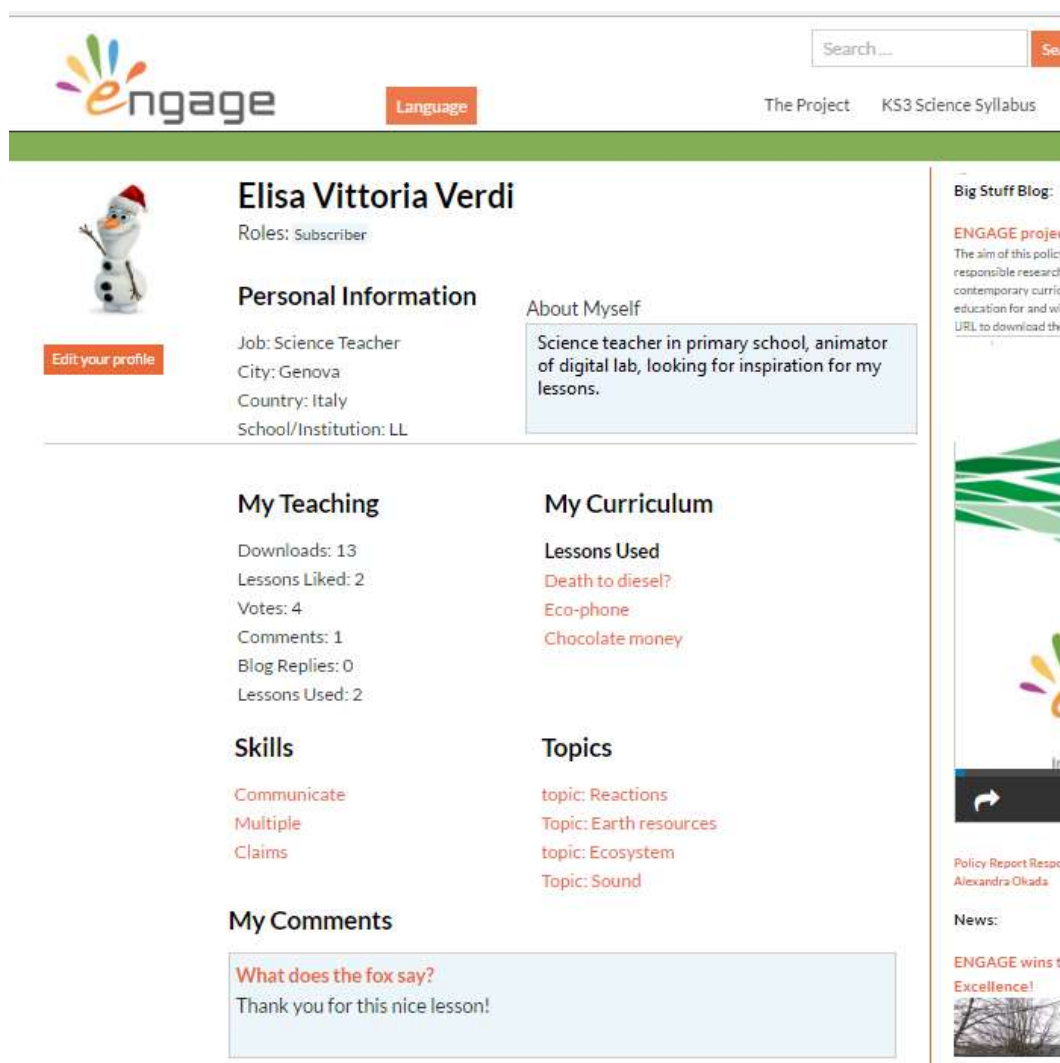

FIGURE 2: OVERVIEW OF MOOC UPDATES IN THE 2ND PERIOD OF THE PROJECT

Objective 1: To create a platform for teachers to access our materials and community

T (Task) 2.1 Platform

During the first half of the period, Lattanzio set up a basic version of the Knowledge Hub via a customisation of WordPress and a first integration with Open edX. While the former was used to deliver materials about RRI and create the first bulks of national communities, the latter was aimed toward delivery of MOOCs.

The main customisation and extension of the WordPress platform during the second part of the project was the ENGAGE profile, showing information about users' ENGAGE-related activities Additionally, customisation and extensions carried on during the second part of the project answered to partners' emerging needs and requests and contributed to the effective training delivery.

FIGURE 3: ENGAGE USER PROFILE

As shown in Figure 3, the ENGAGE user profile shows a minimal set of the user's information together with activity-related statistics and detailed information. "My Teaching" group shows counters for downloads, lessons liked, votes provided, numbers of comments, blog replies and lessons used. "Lessons Used" lists which lessons were commented or liked or rated, with direct links to them, while "Skills" and "Topics" refer to skills and topics related to such lessons. Clicking on a skill or topic shows the list of all lessons dealing with such skill/topic. The lower part shows comments to lessons, with a direct link to them.

A Tag cloud plug-in was set up to enhance search and appeal of the sites. The Tag cloud allows users to quickly understand which tags are used most and to access the list of all lessons tagged with such topics.

FIGURE 4: TAG CLOUD

An Enhanced Video Library page allows a quick and direct access from the platform to videos the on national YouTube channel, grouped by Playlists. Videos can be seen directly from the project portal or by reaching YouTube in one click.
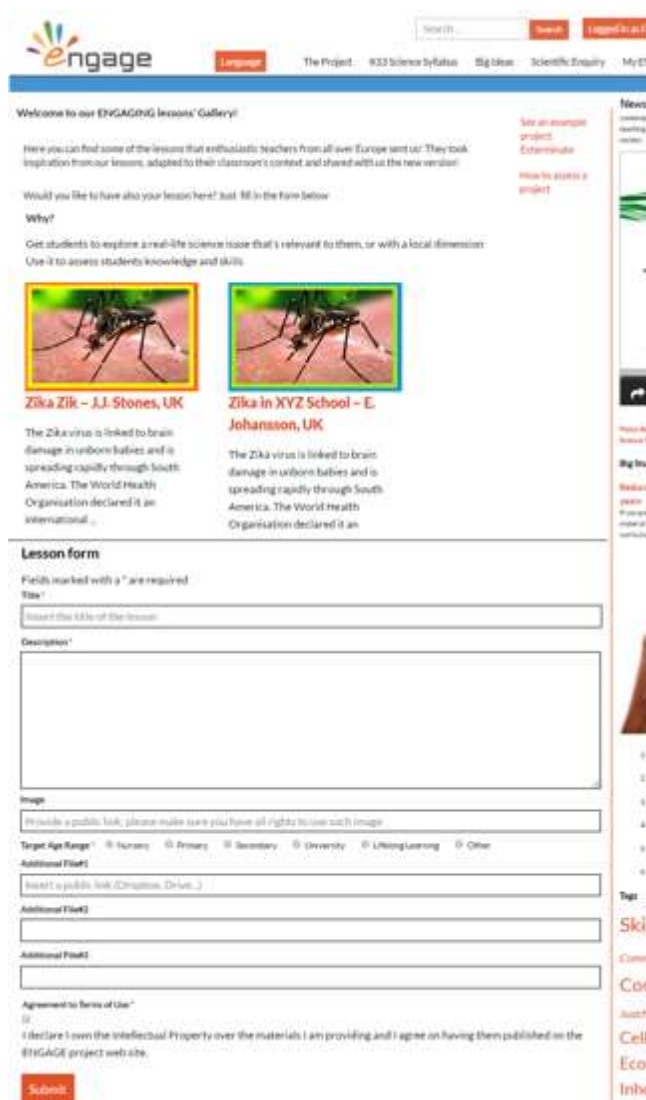
FIGURE 5: ENHANCED VIDEO LIBRARY

To support the TRANSFORM phase, materials were differentiated from the ADOPT and ADAPT phases and supported a different structuring of information.

The Lesson Gallery supported publication of users' lessons. As the TRANSFORM phase supports a deeper users' involvement, we offered them the possibility to send their customisations of ENGAGE lessons and have them published on the national sites. For security reasons end users cannot be allowed to publish posts directly, so information is sent by users via a dedicated form. Data are evaluated by the related national site owner and approved lessons are published on the site into a dedicated gallery.

FIGURE 6: LESSONS GALLERY

Welcome poll to collect data: to be able to collect further data about actual site and resources usage, some partners propose a poll to users right after login. The poll contains three simple questions about the user's usage of ENGAGE resources, his satisfaction and the authorisation for direct contact to gather further information.

FIGURE 7: WELCOME POLL

Updates of reporting facilities were also carried out, such as: the potential to download information about all posts at once instead of only per single post; numbers of downloads for single package, in addition to number of downloads per lesson; data about activity on posts (comments, rates, likes), and grouping of downloads per country of downloaders.

Minor customisations of the WordPress site:

- Removal of flags on the initial page and replacement with a language dropdown. The system remembers the last language selected by the user and automatically re-proposes that language at next access.
- An additional page listing all project deliverables with links for download of public ones.

Monitoring and maintenance activities were also carried out, such as periodical control of suspicious accesses and set-up of proper security plug-ins, i.e. locking out hosts trying to access several times via an admin username. Re-captcha was introduced during the registration process to prevent registration of bots.

As a new, more stable version of Open edX was released, and the server was updated with this new version and consequently updated the SSO integration with WordPress. In addition to this, the following features were provided as a result of partners' requests:

- sending a notification email to MOOC tutors upon a new user's registration to the course
- supporting MOOC authors to switch to participant's view of the course
- providing a special label for tutors answering discussions in forums
- granting tutors an easy access to the list of participants to the course
- providing a file upload facility for course participants: the Staff Graded Assignment (SGA) module allows tutors to get files from course participants (upon a specific request of assignment) and give them a grade. The grade contributes to the overall course grade as per the specified grading policy.
- supporting the generation of certificates for the course

Lattanzio also assisted partners in composing the MOOCs, in particular explaining the grading policy and the generation of certificates, with several one-to-one training sessions over skype with screensharing. Lattanzio also produced a number of written and video-recorded tutorials.

With the new Open edX version, 10 MOOCs were run in one year with 400 registered users.

T2.2 Project Website

The aim of this task, led by OU, was to develop the ENGAGE project website using the platform provided by Task 2.1. This website presents partners' information, meeting presentations, deliverables files, papers, photos and videos. It also includes areas for the consortium to announce workshops, news and ongoing events created during phase Deployment.

An additional site was set up for the Swiss community. This site was not envisaged at the beginning of the project. A specific request came out from the users' community, wishing to have a dedicated site separate from the French one. The set-up was not trivial as the multisite policy adopted in the beginning worked per language. The Swiss site is still uses the French language, but some adjustments were needed.

For the second half of the project, OU coordinated the update of the various sections on the different national portals: publication, blog and news. OU also integrated all slideshares of materials on the website in resources.

Objective 2: To provide information, guidance and support to the use of tools and sharing of experiences

T2.3 Partnership Brokering

This task, led by VUT, set up the partnership brokering system and also uses the platform provided by Task 2.1. The aim of this system was to support schools to find and select relevant 'RRI experts', and create scheduled mentoring partnerships for carrying out the RRI projects which are part of the TRANSFORM step of phase 2 Deployment.

During the second half of the project, the Brokering plug-in was set up for each national site.

From the technical perspective, the Partnership Brokering System (PBS) is implemented as a directory of listings of experts from different areas. The directory is organised in six categories (types of experts): Expert RRI Teachers/Mentors; Media Experts; Science Museum Representatives; Industry Stakeholders; Researchers/Scientists, and Tutors. The main functions of the PBS are:

(a) browse the PBS content (lists of experts and categories);

(b) view the information of a specific expert or all the experts of the same type;

(c) send messages to a specific expert;

(d) introduce new experts in the database, and information about them;

(e) simple and advanced search for a specific expert.

The Partnership Brokering System was initially developed in the English version of the website, and after that it was translated and replicated in all national websites. PBS is integrated in the Knowledge HUB Platform in several ways:

(a) PBS was developed using a WordPress plugin and it is integrated part of the website;

(b) PBS is accessible in every national website through website menu;

(c) the user profile in WordPress was adapted to include a link to expert profile in PBS of that user;

(d) it introduced a new category of users – Experts, and the comments made by these users are marked with a specific tag;

(e) comments made by experts users provides (close to the expert tag) a link to the expert profile in the PBS.

Experts can be added in PBS by any authenticated user, but they are made public only by the website administrator. The information provided by PBS expert profile include: the domain of expertise, years of experience, short biographical data, personal achievements and contact details (e-mail, Skype and Facebook contacts).

Figure 8 presents an expert comment to a local TRANSFORM project in the Romanian website.
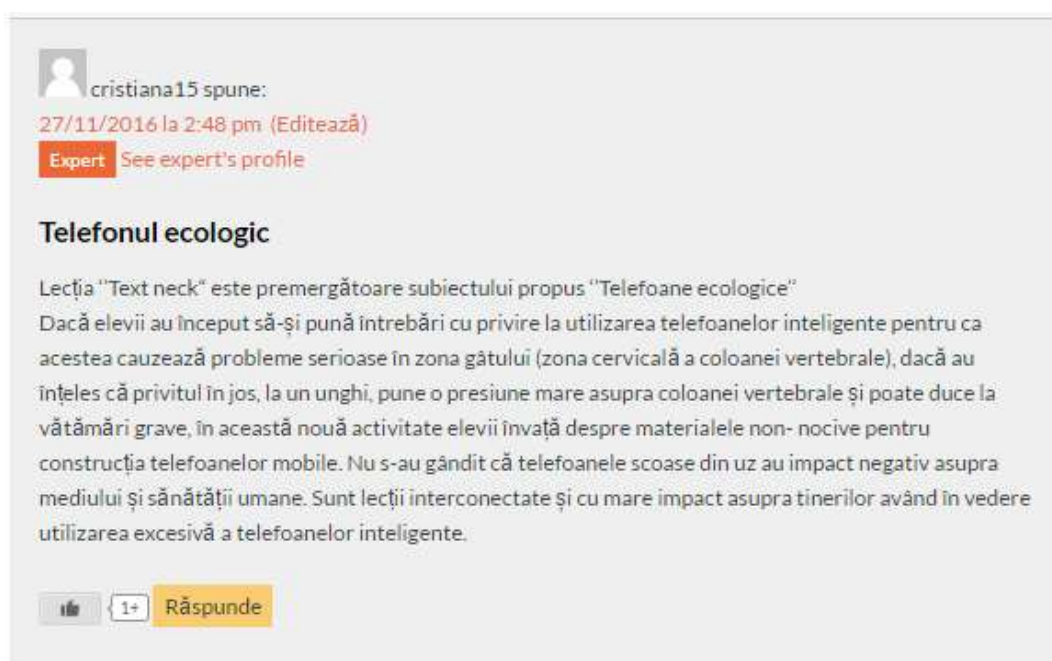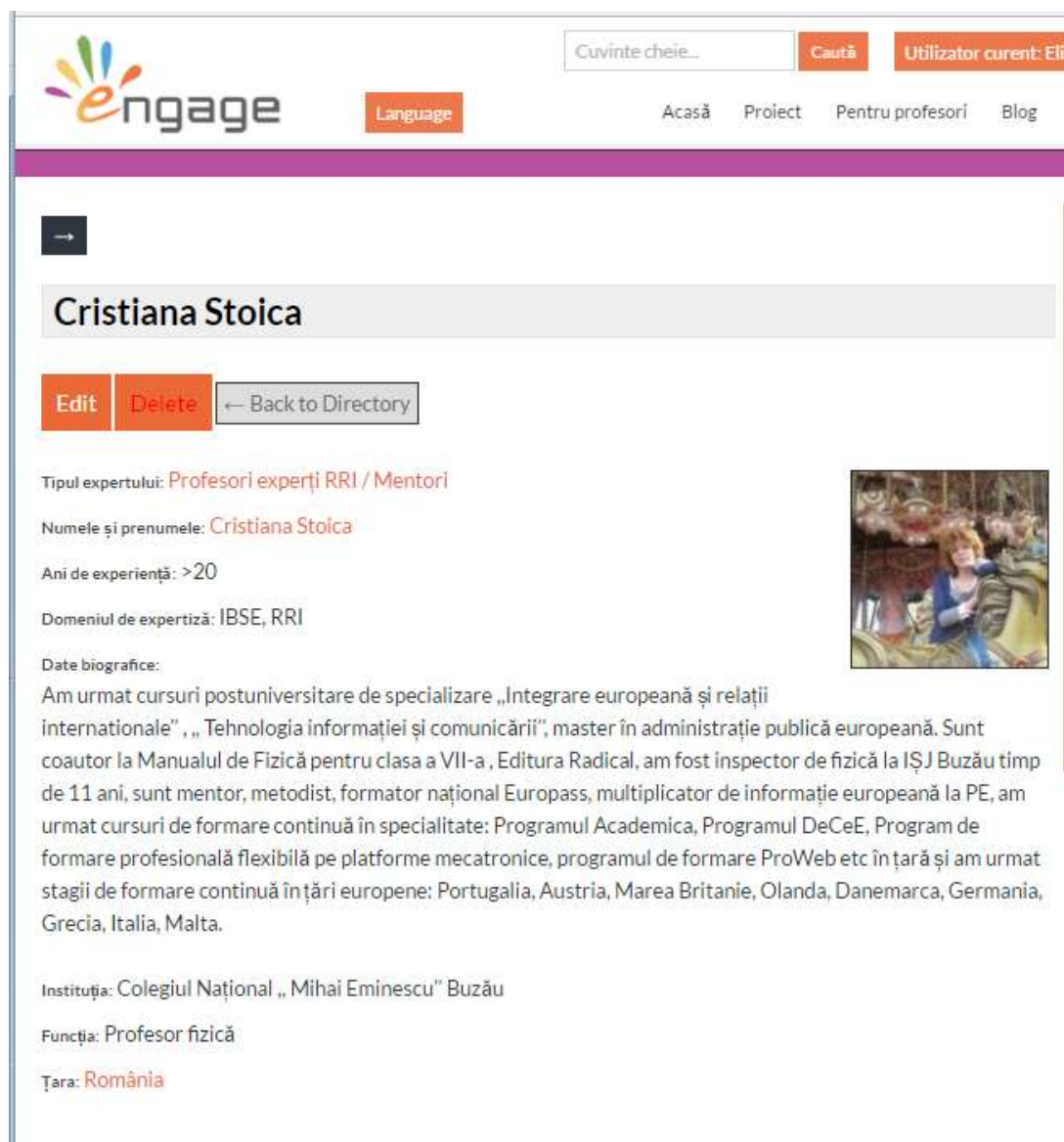
FIGURE 8: EXAMPLE OF AN EXPERT COMMENT

Clicking on "See expert profile" enables access to the Expert's profile from the Brokering system. Figure 9 is an example of a PBS profile for an RRI expert teacher /mentor in the Broker.

FIGURE 9: EXAMPLE OF A PBS PROFILE OF AN EXPERT RRI TEACHER / MENTOR

Objective 3: To build a platform for delivering ENGAGE online courses

T2.4 MOOC
This task, led by OU, dealt with the development of content for MOOCs and Video Library.

After developing the ADOPT content into the first project period, in the second reporting period OU designed and developed the MOOC content for ADAPT and TRANSFORM. This new content was then used for localisation and translation by each country in their own language. The MOOC contents were updated with engaging content including video, quizzes, peer-review tasks, forum discussions, slides and various references.
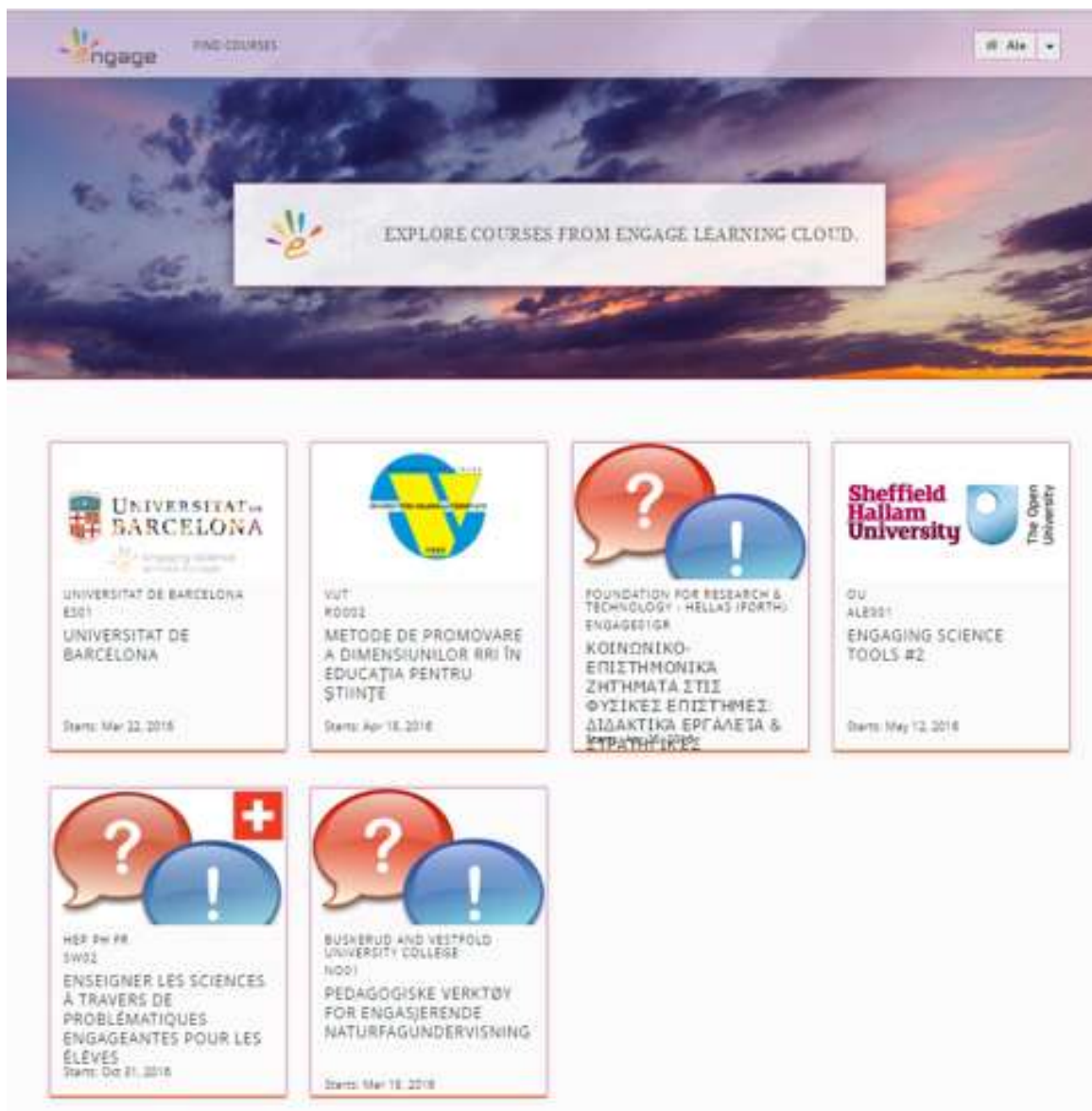
FIGURE 10: MOOCS LIST IN OPENEDX

With the new Open edX version, in the second half of the project 10 MOOCs were run in one year with 400 registered users. Surveys on MOOCs presented very positive feedback from teachers. 46% who replied the survey mentioned that the most useful resources were: 27% Forum, 33% Assignments, 44% Video clips, and 90% Slides/presentations.

In the second project period, OU edited and uploaded more than 10 videos about pedagogical tools, materials, RRI experts, and scientists for the Video Library. Videos were linked with the ENGAGE Portal - materials, news and blogs, as well as with Open edX - MOOCs. Various partners created their own video as well as translating the video animation developed by SHU and guided by HiVe. Video libraries were widely disseminated through newsletters and social media such as Twitter and Facebook.
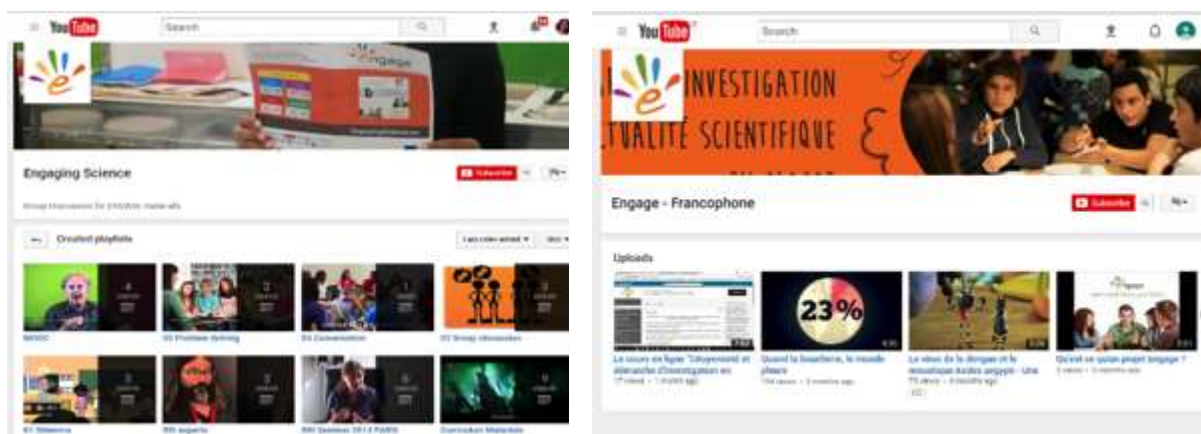
FIGURE 11: UK (LEFT) AND FRANCE (RIGHT) VIDEO LIBRARIES

T2.5 Learning analytics

This task, led by VUT, aimed to provide learning analytic tools for collecting data about students' opinions, values and knowledge before and after using ENGAGE curriculum resources, for formative and summative evaluation. This was done by embedding quizzes and short surveys within the activities of the curriculum resources.

Generally, learning analytics were used for prediction purposes, personalisation and adaptation, intervention and information visualisation. Some software applications were designed for integrated analytics tools, most of them duplicating the functionality of web analytics software, which were also applied to learner interactions with the content. Several social network analysis tools were also used to map social connections and discussions.

Data about teachers' activities in the ENGAGE Knowledge HUB were collected. Several tools were developed, implemented and then used to collect quantitative and qualitative data about teachers' behaviour when using project resources.

The quantitative data were collected using external tools (Google Analytics, AWStats), but also by developing and installing supplementary WordPress plugins: WP Download Manager, WP Statistics, ELS Download Manager, ELS Users Statistics, ELS Export Users to CVS. These tools provide number of users, numbers of downloads, user statistics by location, new visitors, most downloaded lesson etc. Figure 12 gives the users' flow at the level of all ENGAGE websites provided by Google Analytics.
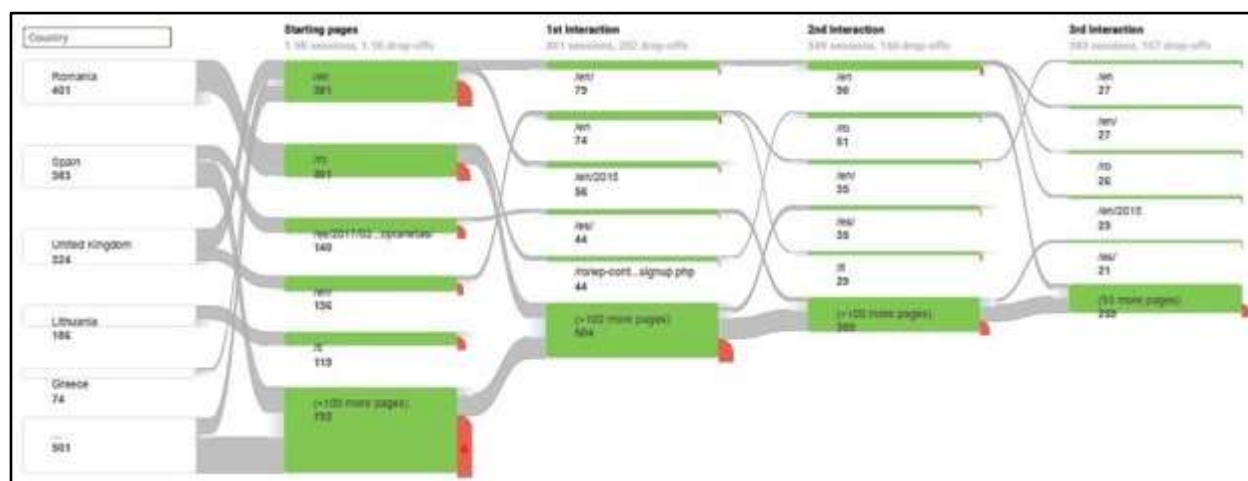
FIGURE 12: USERS FLOW – GOOGLE ANALYTICS (END OF FEBRUARY 2017)

In order to collect qualitative data, we developed quizzes and surveys that were given to teachers before, during and after different activities (online courses, promoting teachers in a new ENGAGE stage etc.). These tools were developed in general using Ninja Forms plugin for WordPress, tools from Open edX platform, but also created using external tools (like SurveyGizmo).

Using the data collected by Learning Analytics tools, every partner was able to monitor their local teaching community. The numbers were reported periodically, centralised, and discussed in online and face-to-face meetings. When circumstances required, partners proposed actions and took measures to guide the local ENGAGE teachers' community to fulfil the project targets.

Resources

Overspending in terms of PMs in WP2 was due mainly to support additional requests from partners for platform updates and extensions, across on the whole period. The development work carried out was necessary to better support RRI training with new features and automatic data extraction for reports. For example, ELS developed a custom view of the user profile showing ENGAGE-specific data. Plug-ins were also developed the Lessons Gallery, the TRANSFORM customisations, the enhanced video gallery and the Welcome polls. As already noted an additional (Swiss) site was set up which was not anticipated in the original plan of work. In addition to this, ELS spent more time than expected training partners to use the platforms, explaining how to carry out work - especially with edX, which was not trivial, in order to enable partners to develop their MOOC capacity. However the prestigious 2017 OER & Project Award for Open Education Excellence was a direct consequence of the additional resources invested.

Partner	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
	SHU	OU	FORTH	FAU	ELS	TRACES	VUT	WEIZMAN	UB	HSN	TU Delf	DICS	LIETUVO	UNic	
Person months - Total for the Project (annex1)	0	9	0	0	24	0	9	0	0	0	0	0	0	0	42
Estimated for the 1st 18 months	0.00	4.50	0.00	0.00	12.00	0.00	4.50	0.00	0.00	0.00	0.00	0.00	0	0.00	21.00
Actual for the 1st 18 months	0.1	4.12	0	0	18.84	0	4.48	0	0	0	0	0	0.00	0	27.54
Estimated for months 19-39	0.00	4.50	0.00	0.00	12.00	0.00	4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.00
Actual for months 19-39	0.1	5.05	0	0	21.34	0	4.52	0	0	0	0	0	0.00	0	31.01

3.3 Work Package 3 - Resources

This Work Package was led by Sheffield Hallam University. The goal of this Work Package was to develop high quality curriculum materials and online course content for the ADOPT, ADAPT, and TRANSFORM stages.

WP3 produced several significant results:

- High quality Dilemma Lesson materials which integrate socio-scientific issues and science content
- Innovative ADAPT materials which explicitly teach RRI processes
- High take-up of materials by teachers in almost all countries
- Content for ADOPT and ADAPT online courses
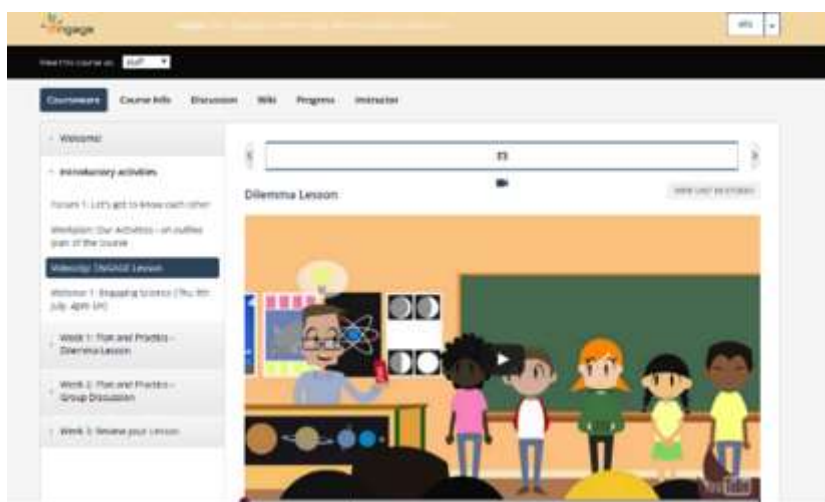
FIGURE 13: AN ANIMATION ON 'DILEMMAS' PRODUCED FOR THE VIDEO LIBRARY AND ONLINE COURSE

Objective 1: A Professional development framework of six Tools

New task

A professional development framework was produced. This Framework described each element of our PD programme, and provided a clear objective and rationale for the strategies chosen. Its purpose was to enable all partners to provide a similar, high standard of input to teachers' development.

However, as the project got underway, it became evident that a CPD framework was needed to inform the development of the workshops. As this was not planned in the DoW, this took time to prepare which had knock-on effects for the subsequent stages of the project. The guiding principles, strategies, prototypes and pedagogical design for the CPD courses in WP2 (Knowledge Hub) and WP3 (Resources) experienced set-backs as a result. As a result, the first ADOPT workshops and MOOCs, originally planned for January/February 2015, did not take place until the summer and autumn 2015.

The starting point was to describe what 'practices' were needed from ENGAGE teachers at the end of the project. The DoW describes five dimensions of 'teacher impact', three of which describe the main changes in moving from being a 'novice' to an 'expert' RRI teacher:

1. Use authentic tasks to help students apply science learning to every-day life (impact dimension 5)

> This practice is a focus for ADOPT, since its purpose is to introduce the teaching of socio-scientific issues through simple to use Materials. 'Authentic tasks' are at the heart of the Materials/

2. Explicitly teach 'RRI skills and knowledge' needed to deal with science issues (dimension 4):

> This practice is a focus for ADAPT, not ADOPT for two reasons. The DoW identified ADAPT with teaching students about RRI, and explicit teaching of RRI skills requires a commitment to spending much more classroom time than is expected in ADOPT.

3. Use open dialogue to build students' reasoning and understanding (dimension 3)

> This practice is also a focus for ADAPT, not ADOPT, mainly because it is probably the hardest practice to implement. It involves a big shift in interaction style from one where the teacher's views and 'correct answers' are dominant to the students' ideas and argument being more important.

CPD tends to be more effective when it focuses on well-defined skills rather than general practices like those above. A similar approach to defining the skills was used in the 'Ambitious Science Teaching' project (Windschitl et al), and the FP7 inquiry project 'TEMI'.

Objective 2: Develop Dilemma lessons to maximise motivation and take-up

T3.1 Process for materials development
This task was successfully completed during the first reporting period, months 1-18.

Resource Materials
ENGAGE has produced a substantial output of curriculum materials, all based on topical issues, to support teachers' classroom implementation of RRI. An example is shown below in Figure 14, and separately uploaded document 'Materials for innovative teachers' showcases this:

FIGURE 14: EXAMPLE CURRICULUM MATERIAL

ENGAGE materials are of three kinds, each designed to support one stage of the project:

FIGURE 15: THE 3 STAGES OF THE PROJECT

T3.4 Localisation

In this task, led by UNic, each partner was to adapt the materials, if this was necessary to fit better the context of the national curriculum. The localised version was sent to the OU partner, who was responsible for publication in the Portal.

Review of localisation by partners: issues and solutions

In order to identify issues and concerns regarding the localisation of the materials and improve the process, the partners were asked to identify any problems experienced at the different stages of the Project (for ADOPT, ADAPT and TRANSFORM Materials).

All partners responded that all materials were translated and localised, at least in terms of making the links to the local curricula. Some of the materials focused on context that was not highly relevant to some of the countries in terms of societal challenges and data relating to them (for example the material on fracking and on solarium that was not relevant for all). Where possible, these materials were localised in a way that national/local societal challenges and relating data are emphasised. Also, where possible, web-links from national websites and data from the individual countries were used. ADAPT and TRANSFORM materials were more challenging for localisation, especially in terms of the terminology used in the teaching tools (for example teaching strategies for small group discussions). It was hard to find a widely agreed translation among the local scholars' community for some teaching tools. In these cases, the national teams either used the English term with a short explanation in the local language on what it is about, or used a local term with the English term in brackets.

h t t p : / / E n g a g i n g S c i e n c e . e u

Objective 3: Create online courses for ADOPT, ADAPT and TRANSFORM

T3.2 Online Courses

T1.5 Video Library
For reasons described in the midterm report, we moved task T1.5 Video Library from WP1 to WP3.

Resources
WP3 resource use closely matched the initial estimates.

Partner	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
	SHU	OU	FORTH	FAU	ELS	TRACES	VUT	WEIZMAN	UB	HSN	TU Delf	DICS	LIETUVO	UNic	
Person months - Total for the Project (annex1)	14	7.5	3	1	0	3	2	2.5	2	1.5	0	2	1.5	4	44
Estimated for the 1st 18 months	7.00	3.75	1.50	0.50	0.00	1.50	1.00	1.25	1.00	0.75	0.00	1.00	0.75	2.00	22.00
Actual for the 1st 18 months	4.2	1.2	0.4	1	0	3.5	0.85	2	1	0.89	0	0.96	1.22	2	19.22
Estimated for months 19-39	7.00	3.75	1.50	0.50	0.00	1.50	1.00	1.25	1.00	0.75	0.00	1.00	0.75	2.00	22.00
Actual for months 19-39	5.2	6.1	1.42	0	0	4	1.15	1.25	1.18	0.2	0	1	0.77	1.9	24.17

3.4 Work Package 4 - ADOPT

This work package was led by the Foundation for Research and Technology - Hellas (Greece). The overall goal of WP4 was to attract large number of teachers into using the ENGAGE materials, to encourage them to use teaching strategies on/for RRI teaching and learning, and to support teachers to propel from the ADOPT to the ADAPT stage in the progressive staircase of involvement.

WP4 produced several significant results during the project
- 22 materials (topicals) that were developed and localised in the course of WP3 have been published and disseminated in 11 national contexts and 10 languages as Open Education Resources.
- More than 16,100 users have been registered in the ENGAGE Knowledge Hub, more than 10,200 have downloaded at least one ADOPT material, and more than 1,750 comments were provided by users on the ADOPT materials.
- Conceptual input on ADOPT RRI pedagogical tools, namely the dilemma lesson and the group discussion tools, were delivered to more than 1200 teachers who participated in workshops and to approximately 400 teachers completing the ADOPT online course.
- 26% of ADOPT users propelled to ADAPT.

Objective 1: To get large numbers of teachers using ENGAGE

T4.1 Localised Dissemination Plan & Networking
During the 2nd project period (M18-M39), partners in the 11 participating countries continued working on the basis of their dissemination plan and strategies (reported in D4.7 –ADOPT dissemination and networking plan) for promoting the newly-

developed ADOPT materials. They also republished and further promoted materials developed in the 1st project period. Good practices in terms of republishing and further disseminating ADOPT materials, in order to recruit new users registered and downloading them, include: making the material relevant to the period/season of republishing (for example "Eat Insects" republished before Christmas vacations, "Three Parents" based on breaking news); republishing of a material based on "Top activity" strategy (materials most popular in each country), and dissemination in terms of curriculum relevance in each period of the academic year.
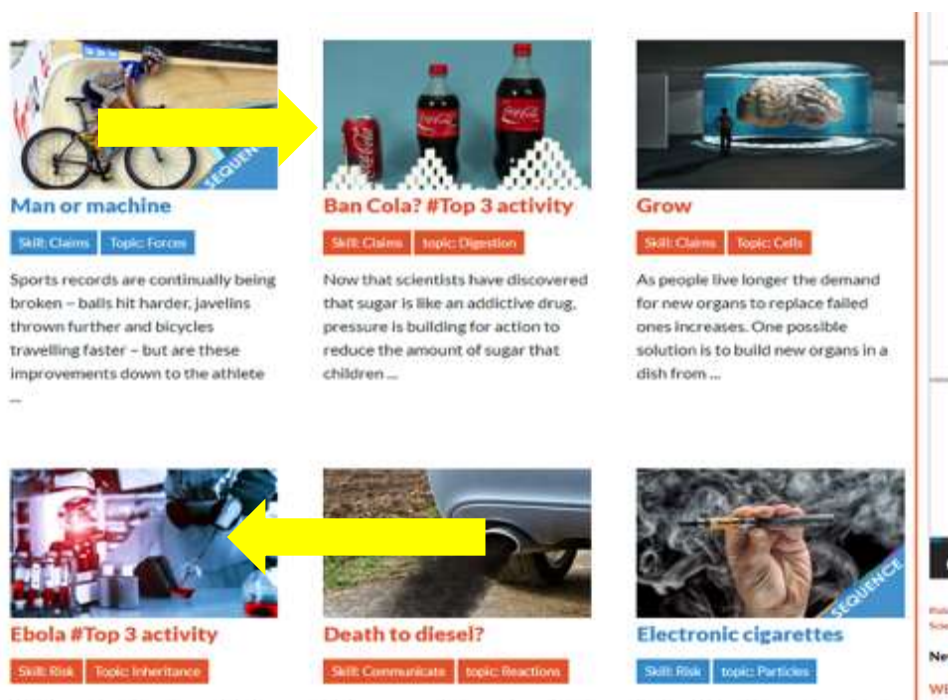
FIGURE 16: GOOD PRACTICE IN TERMS OF REPUBLISHING OF A MATERIAL - "TOP ACTIVITY" STRATEGY, I.E. MATERIALS MOST POPULAR IN EACH COUNTRY

Figure 17 provides country-specific information in terms of the number of teachers downloading ADOPT materials.
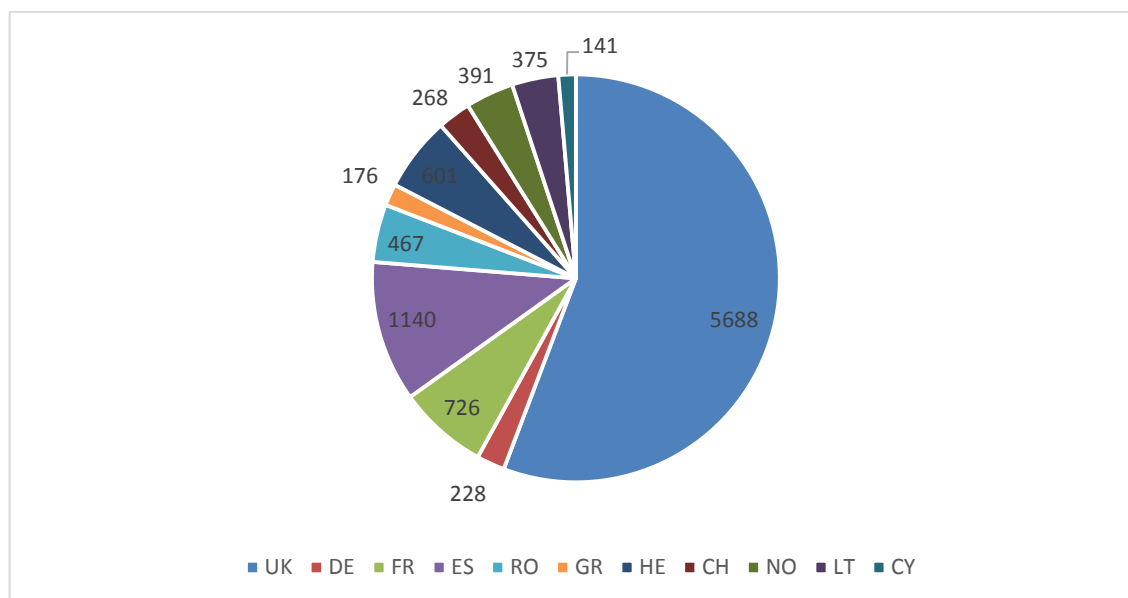
FIGURE 17: TOTAL NUMBER OF DOWNLOADERS IN EACH OF THE 11 COUNTRIES OF THE CONSORTIUM

Evidence on usage of the ADOPT materials in the Knowledge Hub has been provided by more than 1,750 comments published by users, an analysis of which allowed the identification of main characteristics of the materials according to the users (see figure 18).

FIGURE 18:CHARACTERISTICS OF THE ENGAGE ADOPT MATERIALS, AS GIVEN IN 1,759 TEACHERS' COMMENTS IN THE KNOWLEDGE HUB.

Table 1 provides examples of teachers' comments in national platforms on their experiences by using an ADOPT material.

TABLE 1: TEACHERS' COMMENTS ON ADOPT MATERIALS

UK - What Does the Fox Say: "I used this with my top set year 8 at the end of the topic on Wave. Really enjoyable lesson; really good to see pupils applying their knowledge to an unseen idea and the opinions they had. Really thought-provoking and good activity to get them thinking outside the box! Would definitely use again."	**DE** - Grow Your Own Body: "My current rating is based on the sighting of the material, since I can unfortunately only test the lesson in the next week. The material seems to me really interesting and well-suited and when I gave the pupils this teaching content in prospect, they were immediately very dedicated!"
FR - Invasion: "Very good resource. Used with a 15 years old class of 30. The sequence lasted 2 hours. The students were interested and they understood the principle of biological control and knew how to reinvest their knowledge afterwards. Thank you ENGAGE!"	**CY** - Text Neck: "Very interesting material, it gave students the opportunity to reflect on the on the consequences of an irrational use of mobiles."
RO - Ban Cola: "After presenting this material in class (on which I am class master) and implicitly by the help of other students in the class that already knew the harmful effects of carbonated drinks, we managed to capture the interest of other students in class that frequently consumed this drink. In the shortest time, all students in the class, based on a program they established, eliminated consumption of this carbonated beverage. At their insistence we proposed a project with this subject at the level of the school, so they will try to transmit what they have learned to other colleagues in the school."	**GR** - Appliance Science: "This lesson was the first of the ENGAGE materials that I applied in the classroom where I teach (5th grade) {…} Students' motivation was high from the beginning. Their interest remained high during the period of activity, while the activities did not tire students. It seems that the sequence of activities was very good, students got the initiative to engage in the dialogic process, highlighting the views and concerns (their habits) of the proper use of electricity and thus ways of modification of their habits…"
HE - GM Food: "I chose to teach GM food to 10th grade students with no prior knowledge on the topic. I created small groups of 4 according to the instruction. Each group learned their information regarding the argument they need to present. Then they wrote arguments and justified them. I used the class discussion tool to talk about norms of discussions. During discussion I was the	**CH** - Life on Enceladus? "This activity allows students to distance themselves from the classical school problem-solving approach and practice an open problem. The fact that it is a topical issue attracts students' interest. The activity represents an opportunity for students to question what a "proof" or "fact" represents and to understand how scientific research works. It allows them to develop their

facilitator and mediator. The students followed the rules of discussion that we wrote before. I did not have to intervene at all. The discussion was very live and fruitful. It was an exciting lesson."	critical thinking, the ability to doubt and put forward affirmations in question, but also to argue and debate. The fact that there will be no definitive answer at the end will surely be perceived as destabilising by the students, but it is this fact that makes the experience authentic."
LT- Car Wars: "I used the material with students. The students liked a theme of the lesson, and they asked many questions and tried to find evidences for their opinions. Students were engaged by the improvement of engines of cars. According to students, they did not know that cars emit quite a big amount of pollutants to atmosphere. It was easy work for me according to the prepared teaching material."	**ES** - Text Neck: "This educational resource has been useful to me in the subject of Scientific Culture, where students, regardless of Sciences or Humanities, have been attracted by the content and questions formulated in this resource. The possibilities of inquiry are multiple and we have not only focused on the neck but also extended our hands and fingers to understand the anatomy and physiology of these members a little better. The results were very satisfactory. Many thanks to the ENGAGE team for incorporating this type of resources."

T4.2 Programme implementation, workshops and MOOC

During the lifetime of the project, at least two workshops were conducted in each of the 11 countries of the consortium on the dilemma and group discussion teaching strategies, engaging a total of 1268 teachers (far beyond the initial target of 645 teachers set in the DoW). Figure 19 provides country-specific information on the numbers of teachers participating in ADOPT workshops in the lifetime of the project.
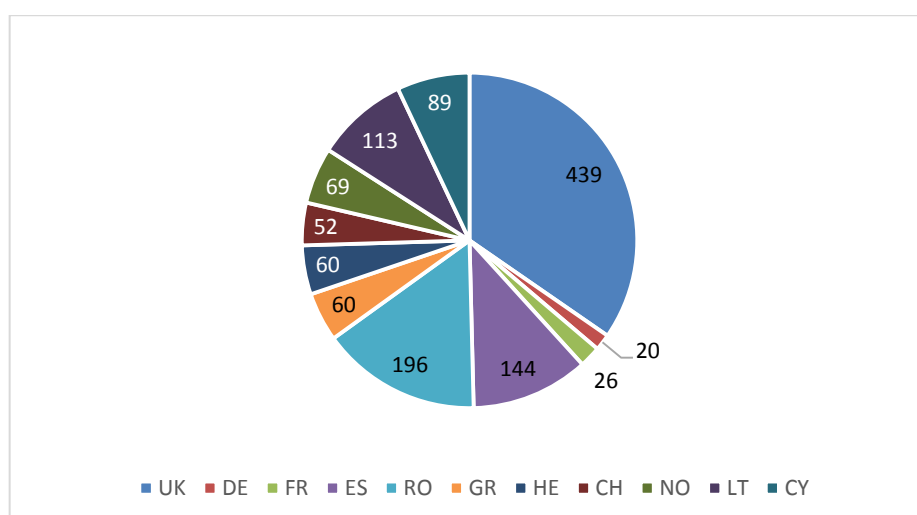
FIGURE 19: NUMBERS OF TEACHERS WHO PARTICIPATED IN ADOPT WORKSHOPS ON DILEMMA AND GROUP DISCUSSION STATEGIES IN EACH COUNTRY

As evident from the partners' reports on workshop implementation (see D4.8), important outcomes of the workshops include: the familiarisation of teachers with dilemma and small group discussion RRI teaching strategies; the hands-on engagement with the ADOPT materials, and the motivation to participate and engage in the online courses for more in-depth understanding and knowledge co-sharing.
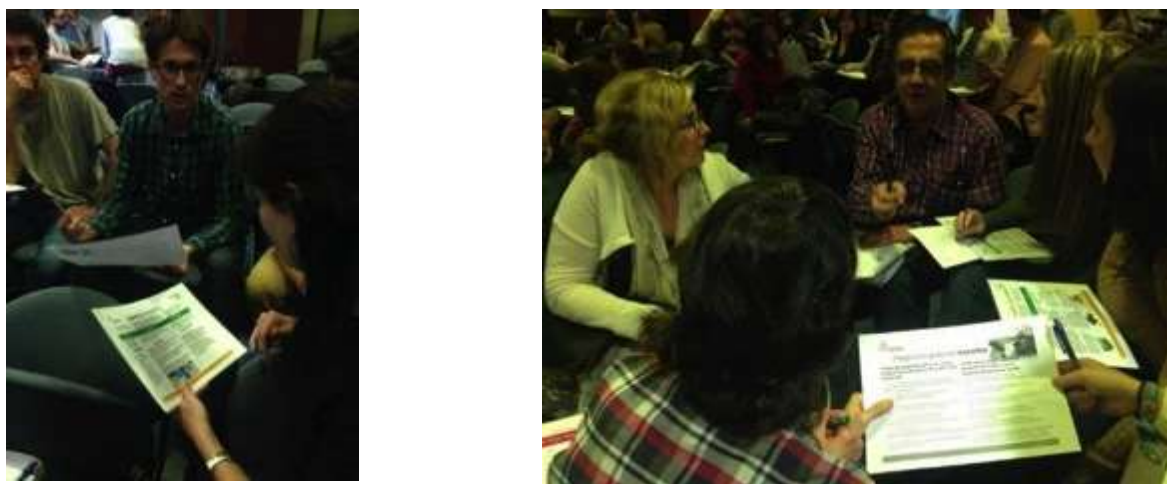
FIGURE 20: PHOTOS FROM A SPANISH ADOPT WORKSHOP
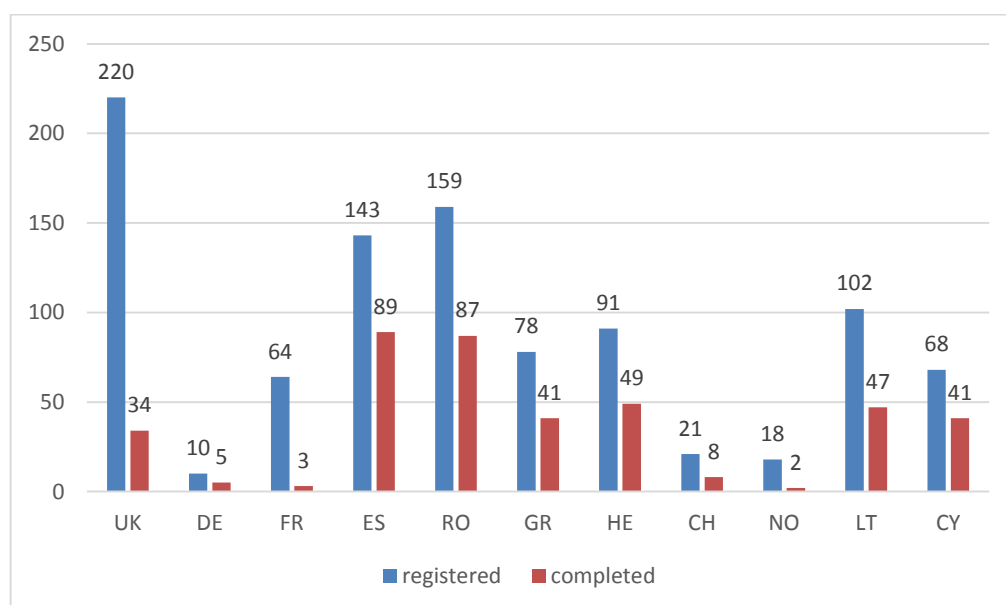
FIGURE 21: NUMBERS OF TEACHERS REGISTERED AND COMPLETED ADOPT ONLINE COURSES

While in total the ***completion rate was more than 40%*** - which is average compared to international rates - there were differences among countries in terms of the completion rates and the success of the online courses. In the UK, for example, as commented by the UK partners:

"Since the first online course had very low numbers of teachers, it was clear that teachers in the UK did not have time to participate in an extended online course. This fits with other evidence that UK teachers have little time for CPD due to

intense accountability pressures. However, they did want to access CPD resources on a just-in-time basis. We decided that it was better to use our resources to create online videos and web pages, and link them to the use of the materials, which teachers could use for 'just-in-time' CPD. So we have created these and they are on the ENGAGE website, and can be used as a 'personalised CPD course' or for teachers to dip into as needed. This has long-lasting potential, though less intensive than the online course".

In Switzerland, on the other hand, as commented by our Swiss partners:

"Online courses are new in French-speaking Switzerland and teachers are still not used to following them. Setting up an online course demands a lot of time and preparation. It was very challenging to set up the first one and to have enough time to do publicity for it. Indeed, we realise that it helps a lot to do publicity through the official websites of the institutions for teacher education and this was not possible for the first course (only 5 teachers registered and 2 completed it). For the second one it was much better: we announced it in three institutions (Fribourg, Valais and Bejune) and we got 11 registrants through them (plus other 5 directly through the ENGAGE site users), and 6 completed it. All the teachers that completed the course had registered through the institutions (4 Bejune, 1 Fribourg, 1 Valais)."

On the other hand, the Lithuanian and the Greek online courses were very successful and an effective means for supporting knowledge and experience exchange, as evident from the **more than 600 posts in the Lithuanian case, and more than 100 posts in 15 discussion topics in the Greek case** (these figures concern both ADOPT and ADAPT courses, as in these countries they were delivered as a joint course).

FIGURE 22: A SCREENSHOT OF THE LITHUANIAN ONLINE COURSE

The online courses in the different countries were based on common content (developed in the course of WP3), but differed among countries in terms of the structure, the mode of delivery and the facilitation. A place-based approach of delivery was decided in order to make courses most relevant to different national contexts and teachers attitudes. In the UK for example, methods used for the delivery included forum posting, review questions, assignment activity and webinars. Teachers were keen to pick and choose some elements more than others, hence the open-buffet style of later TRANSFORM CPD. Webinars were only lightly attended, however they generated discussion amongst those who took part. Posting proved a good means to generate discussion across a longer time period. The Greek and the Spanish online courses on the other followed a more structured and rather traditional mode of delivery, with content, tasks and

assignments being uploaded each week by the course facilitators. In the Spanish courses, each teacher created their padlet to upload lesson plans with ENGAGE materials or RRI CPD tools, as well as photos from the lesson, student products and lesson reflections. Each teacher had to comment on the padlet from another teacher as part of the activities to complete the course. Facilitators commented on the padlets as well. The above are examples of how the courses in different cases supported interaction with other teachers and facilitators.

Concluding, the online courses helped participant teachers familiarise with RRI teaching pedagogies – as per partners reporting – in terms of:

UK: "Enabling teachers to access a range of different materials in a semi-structured way. The standard of reflection of the successful assignments was generally very impressive and indicated evidence of learning from the course."

NO: "Teachers reported slideshows, texts and feedback on assignments as most useful. They also tested a material in class."

LT: "Teachers participating in the online course had much more time to analyse and to study ENGAGE methodology and RRI pedagogies than those who had participated in one-day seminars. Teachers wrote many comments in EdX platform, and they could help each other to overcome some difficulties. Therefore, teachers had to use at least one ENGAGE teaching material with students, so they got practical experience and used theoretical knowledge in practice."

GR: "Teachers showed an impressive level of reflection on provided sources – as evident from their assignments - and engaged in deep discussions with other teachers. A characteristic comment of a teacher in the evaluation form was that he did not expect to learn so much from discussing with colleagues."

Regardless of the completion rates, it is important to note that 93% of the teachers participating in the ADAPT online courses (on problem solving and whole class discussion tools) had previously been involved in the ADOPT online course – which an indication of the success of the ADOPT course in relation to the one of the main objectives of WP4, i.e. to help teachers propel from the ADOPT to the ADAPT stage in the progressive staircase of involvement.

Objective 2: To support teacher reflection with online content

T4.3 Online Content for reflection

During the lifetime of the project, the consortium regularly updated the Knowledge HUB by publishing new materials, and republishing and disseminating ADOPT materials based on analysis of most popular and most commented materials on each country (see T4.1 above).
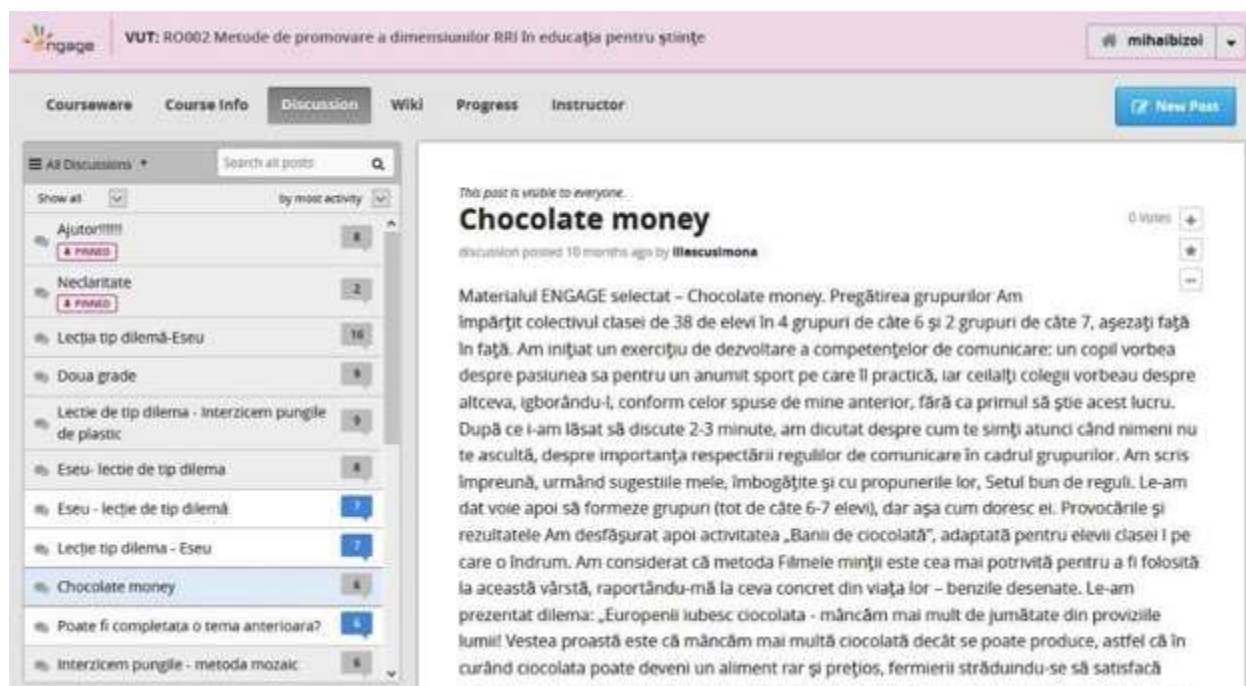
FIGURE 23: REFLECTIVE COMMENT IN ROMANIAN ON OPEN EDX PLATFORM

T4.4 Video Library (led by HBV – moved to WP3 by agreement from WP1)

For reasons described in the midterm report, the consortium decided to move the T1.5 Video Library from WP1 to WP3, and chose to make animation videos on RRI pedagogies in English that could be translated to each partner's language, instead of making national videos on RRI pedagogies. The partners were provided with instructions both for changing voiceover and for adding subtitles.

The partners, especially SHU and HBV, collaborated on producing a brief and script for two animation videos - one on dilemma and one on group discussions - that were produced by an animator at SHU. In addition, SHU produced a talking head introduction to ENGAGE. These three videos were made especially for use in ADOPT online courses. We also started planning an animation on the pedagogical tools of ADAPT but this was not produced due to time constraints. In addition to these common videos, the partners produced different sorts of videos themselves depending on their national needs. These videos include dissemination videos, different versions of videos of the presentations for the online courses, raw or formatted recordings of online courses webinars, RRI expert videos etc. Some partners also used freely available external videos, and a system for exchanging links to external videos was provided to the partners. Links to the different countries' Video Libraries can be found in "The exploitation plan", D7.14.

The main use of most of the videos found in the different countries' Video Libraries (see "The exploitation plan", D7.14 for links) have been in the online courses. In the overall responses to our online courses post-course survey, 43.2 % of the teachers found the video clips to be the most useful activity of the online courses, with the first PowerPoint presentation, on Dilemma, on a close second (42.5%).

In addition, presentations on ENGAGE, RRI experts and videos from the RRI seminar in Paris 2014 have been used for dissemination and information on the ENGAGE website.
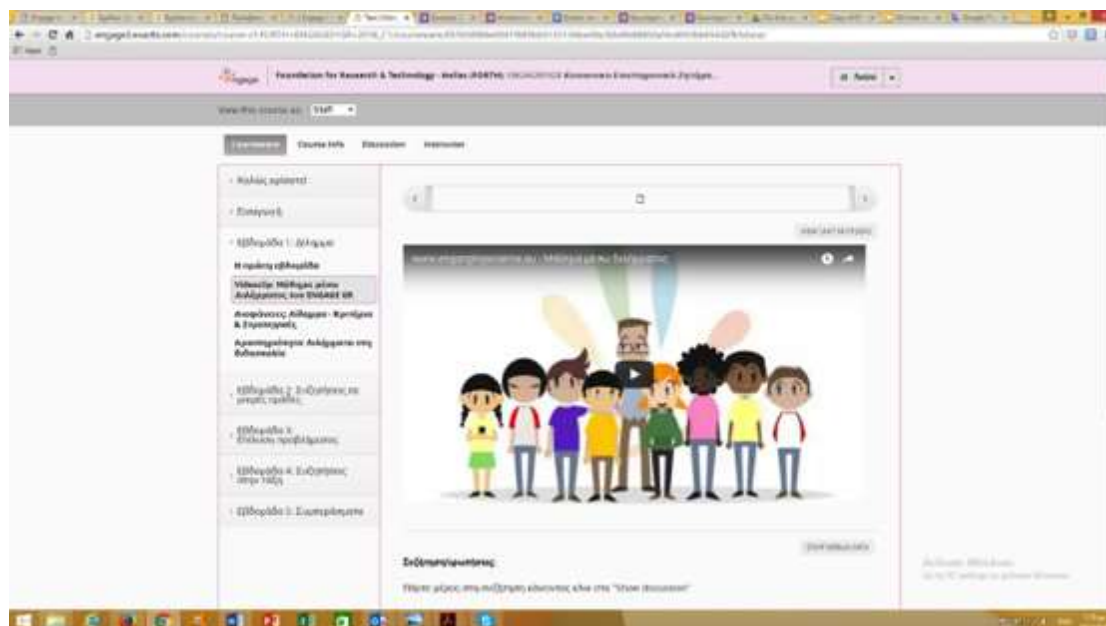
FIGURE 24: VIDEO WITH GREEK SUBTITLES EMBEDDED IN THE GREEK ONLINE COURSE

Resources

The ADOPT phase has run as to plan but with slightly more resource needed than anticipated at the start of the project. ADOPT has been the best embedded of our three phases but this required some additional resource in the first phase of the project to enable this to happen.

Partner	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
	SHU	OU	FORTH	FAU	ELS	TRACES	VUT	WEIZMAN	UB	HSN	TU Delf	DICS	LIETUVO	UNic	
Person months - Total for the Project (annex1)	4.5	0	7	4.5	0	4	3.5	3.5	4.5	3.5	0	3.5	3.5	3.5	45.5
Estimated for the 1st 18 months	2.25	0.00	3.50	2.25	0.00	2.00	1.75	1.75	2.25	1.75	0.00	1.75	1.75	1.75	22.75
Actual for the 1st 18 months	2.1	0	3.37	4.5	0	4.5	0.94	1.75	2.55	0.92	0	2.86	2.93	1.78	28.2
Estimated for months 19-39	2.25	0.00	3.50	2.25	0.00	2.00	1.75	1.75	2.25	1.75	0.00	1.75	1.75	1.75	22.75
Actual for months 19-39	1.4	0	3.44	1	0	4	2.56	2	3.06	1.74	0	0.49	1.37	1.7	22.76

3.5 Work Package 5 - ADAPT

This Work Package was led by Universitat de Barcelona (Spain). The goal of this Work Package was to plan and monitor a dissemination strategy for the ADAPT stage of the ENGAGE professional development programme. The programme included classroom materials, online courses, and community. The main goal of the programme was to support teachers in acquiring a greater commitment to RRI teaching than on the previous stage, i.e. ADOPT.

WP5 produced several significant results:
- 12 ADAPT 'Sequences' have been published in 11 National Knowledge Hubs.
- Teachers are downloading, using materials, and providing feedback in National Knowledge Hubs.

- Conceptual input on the ADAPT RRI pedagogical tools, namely group discussion and conversation, has been delivered to 478 teachers via MOOCs.
- Teachers have engaged in discussions about the ADAPT RRI pedagogical tools with other teachers and facilitators, mainly during MOOCs.
- Supporting teachers to progress from ADOPT to ADAPT:
    - 26% of ADOPT users are now ADAPT users
    - 93% of ADAPT MOOC participants had previously participated in the ADOPT MOOC
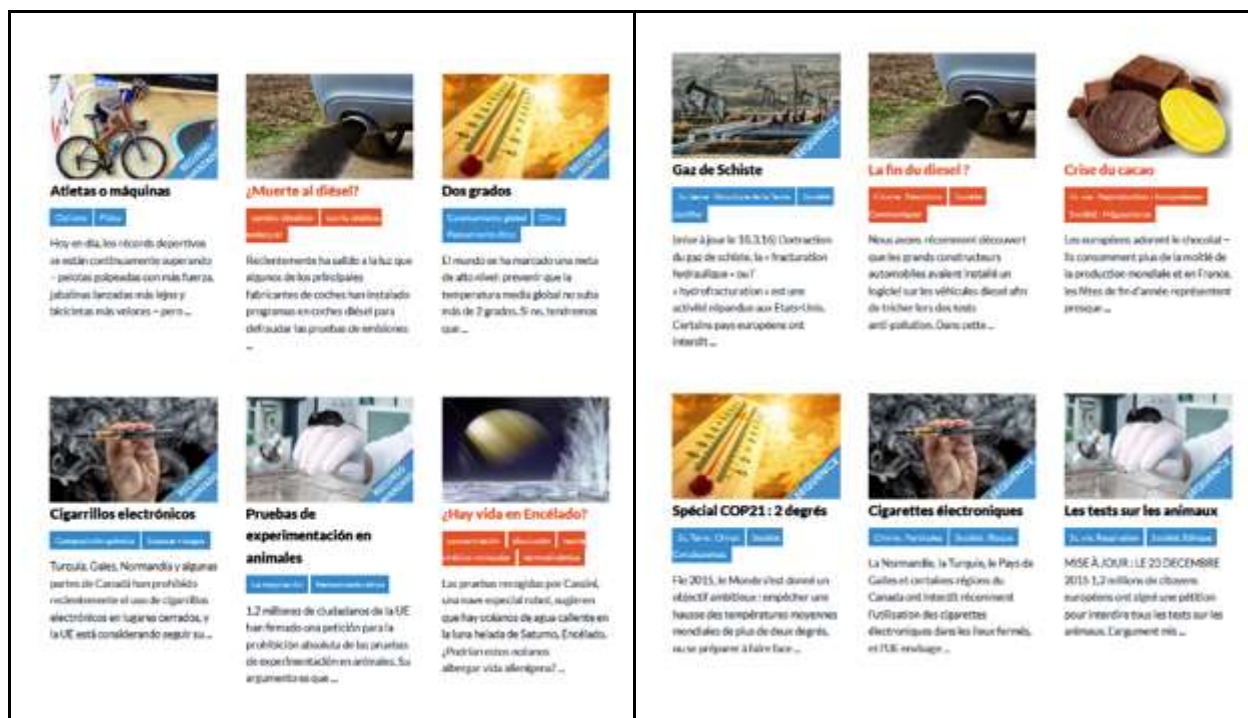
FIGURE 25: SCREENSHOT SHOWING A SELECTION OF THE ADAPT MATERIALS, WHICH ARE IN BLUE COLOUR, PUBLISHED AT THE SPANISH (LEFT) AND FRENCH (RIGHT) KNOWLEDGE HUBS.

Objective 1: To 'deliver' the ADAPT stage in each partner country

T5.1 Localised Dissemination Plan &Networking

Building on the first 18 months of the project, between months 18 and 39 we revised the ADAPT dissemination strategy and shared it with partners. This whole process led to the following significant results:

a) Four ADAPT materials have been published since the mid-term report.
b) A total of 3,150 users are now downloading ADAPT materials, boosted by an email campaign publicising new materials see Figure 26. The system for voting and liking the materials is in place and working.
c) UB has led the localisation, adaptation and delivery of ADAPT MOOCs in nine languages. At least 478 teachers enrolled the ADAPT MOOCs, and 172 users completed them.
d) The MOOC was an effective means for supporting exchange and community-building around RRI pedagogies in some countries. For example, in the Lithuanian MOOC there are more than 600 forum posts. In the Greek MOOC there are more than 100 posts from teachers in total, in more than 15 discussion topics.

FIGURE 26: SCREENSHOTS OF ADAPT MAILING CAMPAIGNS FROM SWITZERLAND (LEFT) AND THE UK (RIGHT).

Objective 2: To support teachers in transitioning to RRI-based teaching

T5.2 Programme Implementation & MOOC

We have successfully supported the requested share of ADOPT teachers to move on to ADAPT. These teachers have used ADAPT materials and/or participated in the ADAPT MOOC after having done so for ADOPT.

From a total of 11940 ADOPT users in National Knowledge Hubs, 3190 became ADAPT users. This means that 26% of ADOPT users upgraded their profile to ADAPT.

From a total of 236 teachers who enrolled the ADAPT MOOCs, 220 had been in the ADOPT MOOC. This means that 93% of teachers who undertook the ADAPT MOOC had previously been involved in the ADOPT MOOC.

T5.3 Mentoring to support change practice   (next reporting period)

As an example, in the case of Romania, the Expert RRI teachers were identified from the teachers who participated in previous projects related to IBSE and RRI. All the teachers had some experience on mentoring in the frame of some national programs. The experts were recruited and they graduate the first ADOPT-ADAPT MOOC, obtaining in this way knowledge about ENGAGE project, RRI dimensions and 3 stage model. Later, they were trained about mentoring on issues related to RRI and ENGAGE philosophy in a face-to-face meeting.

Resources

As with Work package 4, a greater resource investment was needed within WP5 from partner 9 (UB) to successfully embed the ADAPT phase of the project.

Partner	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
	SHU	OU	FORTH	FAU	ELS	TRACES	VUT	WEIZMAN	UB	HSN	TU Delf	DICS	LIETUVO	UNic	
Person months - Total for the Project (annex1)	3	0	3	3	0	2.5	2	2	5	2	0	2	2	2	28.5
Estimated for the 1st 18 months	1.00	0.00	1.00	1.00	0.00	0.83	0.67	0.67	1.67	0.67	0.00	0.67	0.67	0.67	9.52
Actual for the 1st 18 months	0	0	0	1.5	0	0.5	0	0	2	0.05	0	0	0.00	0.91	4.96
Estimated for months 19-39	2.00	0.00	2.00	2.00	0.00	1.67	1.33	1.33	3.33	1.33	0.00	1.33	1.33	1.33	18.98
Actual for months 19-39	2	0	3	2.5	0	4.5	2	2.2	4.49	1.66	0	1.9	2.00	1.5	27.75

3.6 Work Package 6 - TRANSFORM

This Work Package was led by TRACES (France). The goal was to catalyse the transformation of teachers coming from earlier stages to become 'expert RRI teachers' who know how to teach using socio-scientific issues. The main objectives as set in the DoW were:

- To propel a proportion of teachers from the ADAPT stage to reach the 'transformational' stage, through experiences such as co-creation of resources, training other teachers or mentoring.
- To encourage deeper, sustained reflection about teacher practice and the nature of science, its applications and implications, and its importance for students' futures and society.
- To equip these teachers as the 'go-to person' in a science department, who can support colleagues in developing their own RRI practice.

Based on discussion and feedbacks from the ADOPT and ADAPT stages, the TRANSFORM phase was characterised by the following priorities (details are presented in D6.12)

- Involvement of relevant stakeholders in the process (mainly scientists, media, and informal science education institutions)
- Focus on an open-ended, project based pedagogy
- ENGAGEment of 'expert' teachers. Teachers become authors of their projects.
- Focus on RRI issues: role of media; ethics; socio-scientific issues; socially relevant impacts of research, the nature of science in society etc.

WP6 produced several results:
- Identification of key issues in bridging RRI and science education, through RRI seminars
- Reaching of clear and shared definition of "RRI teaching" and its implications
- Piloting of TRANSFORM projects
- Production of local materials

Objective 1: To propel a proportion of teachers to the transformational stage

T6.1 National Experts Networking & collaboration

A localised networking plan was designed in the first period of the TRANSFORM phase following the identification of three main key stakeholders, namely: scientists and research institutions; journalists and the media, and informal science education institutions. Other stakeholders (such as business institutions) were identified as important, but were not put as a high priority to ensure an actual implementation of this essential part of RRI teaching. A rationale for these choices was reported in D6.11. A set of stakeholders from each of the above category was contacted by partners (see list below). This shows very good effort, but also confirms a major difficulty for formal science education institutions in linking with different types of expertise and professions.

Efforts were made by the WP coordinator and the partners to clarify the nature of the difficulties in achieving a key RRI teaching feature: linking with science and the media reporting of science. This led to a series of recommendations and guidelines for stakeholder involvement, presented during consortium meetings and summarised in D6.11.

A key learning outcome of this task was the need of strong efforts in supporting formal education institutions and researchers to adopt an open schooling approach.

The main contacts with stakeholder per country were:

- Germany: Helmholz Institute (Dresden), Teachers Online (German Teachers' Community), Schülerforschungszentrum Nordhessen (Kassel), Schülerfoschungszentrum (Berchtesgardner Land), Nordhessen (Kassel), "Schülerfoschungszentrum (Berchtesgardner Land)"
- UK: Sheffield Hallam, Open University Centre for Sports Engineering Research, Sheffield Museums Trust, AQA, Kings College London
- France: AgroParisTech, ESPCI Paris, PSL, Wax Science, La main à la Pate, ASTEP, Inversons la classe, ESTIM-Ecole de la médiation, Musée des Arts et Métiers, Universcience.
- Romania: Union of Professional Journalists in Romania, Institute of Multidisciplinary Research for Science and Technology from Valahia University of Targoviste, "Curtea Domneasca" National Complex Museum Targoviste
- Greece: Pedagogical Institute of University of Crete, Museum of Natural Sciences Heraklion
- Norway: Forskning.no, Norwegian University of life sciences, Natural History museum Oslo, The Norwegian Biotechnology Advisory Board, Stena recycling
- Switzerland: CERF, University of Fribourg
- Lithuania: Žaliasis pasaulis, Sciences Research Institute, LEU, Lithuanian Centre of Non-formal Youth Education
- Cyprus: Paideia News, Institute of Genetics and Neurology Cyprus, Pedoulas Environmental Center, Labrou Agro

TRANSFORM activities also allowed partners to share valuable experiences in innovative teaching practices. In fact, a gallery of what were named "TRANSFORM-like local projects" proved a very high degree of creativity among all partners, and showed the benefits of European sharing of such practices. Such projects, discussed in consortium meeting and included as D6.12, were also used as a basis for inspiring local TRANSFORM projects within the ENGAGE programme.

FIGURE 27 AN EXAMPLE OF THE FRENCH PARTNER'S ONLINE SOCIAL NETWORKING PROMOTION FOR ENGAGE

T6.2 Brokering School & Experts Partnerships

Dissemination strategy for TRANSFORM were set out in Deliverable D6.11; table 2 below summarises the publicising of the TRANSFORM activities.

TABLE 2: PUBLICITY FOR TRANSFORM

Country	Email campaigns	Newsletter	Event	Number of teachers reached
Germany	Yes	Yes	Yes	805
UK	Yes	Yes	Yes	735
France	Yes	Yes	Yes	3160
Spain	Yes	Yes	No	500
Romania	Yes	Yes	No	1600
Greece	Yes	Yes	Yes	300
Israel	Yes	Yes	No	
Norway	Yes	Yes	No	2000
Switzerland	Yes	Yes	Yes	1174
Lithuania	Yes	Yes	Yes	2100
Cyprus	Yes	Yes	Yes	600

T6.3 Programme Implementation & MOOC

The TRANSFORM phase of ENGAGE experienced some delays due to a cascade effect of delays in the previous phases, and unfortunate timing with respect to the school year requirements. The main impact of the delay was not necessarily the timing factor, but the difficulty for TRANSFORM local projects to inform, motivate and involve the teacher community that was engaged in the previous stages.

Despite these drawbacks, TRANSFORM was successfully implemented in all countries with limited levels of success, with the development of two types of materials: local and global.

Global and local TRANSFORM

Two global TRANSFORM projects were developed centrally, including a blend of ADAPT-like materials and guidelines for supporting teacher independent work. The two topics are "Exterminate" and "Ecophone".

FIGURE 28: SCREENSHOT OF THE GLOBAL "ECOPHONE" PROJECT FROM THE LITHUANIAN SITE

Table 3 shows the impact of these materials per country:

TABLE 3: DOWNLOADS OF GLOBAL TRANSFORM PROJECT MATERIALS BY COUNTRY

Country	Target (Local + Global)	Downloads Exterminate	Downloads Echophone
Germany	80	16	9

UK	60	1056	1017
France	60	150	273
Spain	60	381	268
Romania	20	407	521
Greece	20	49	53
Israel	20	18	27
Norway	15	75	72
Switzerland	10	46	6
Lithuania	10	248	179
Cyprus	10	19	19

Local TRANSFORM projects were defined as "Teacher-led projects involving scientists/media/museums... (that is, they involve direct contacts with real life situations/actors)".

Three options were provided to partners to implement local TRANSFORM projects, which could be:

- inspired by global TRANSFORM project
- based on existing ADAPT or ADOPT materials
- fully original RRI teaching projects developed by TRANSFORM teachers

All partners implemented at least one local TRANSFORM project; in some cases, (such as Romania) TRANSFORM projects were included in the MOOC as specific assignments for teachers. Table 4 shows some examples of the variety of topics.

TABLE 4: EXAMPLES OF LOCAL TRANSFORM PROJECTS IN EACH COUNTRY

Country	Theme
Germany	Vaccines
UK	Man or machine
France	Feed the world
Spain	Exo-planet

Romania	City of the future
Greece	Vaccines
Israel	Diamond blood or synthetic diamonds
Norway	Plastic waste
Switzerland	Invasion (reintroducing the wolf)
Lithuania	E-textile and firefighter
Cyprus	Blood test and embryo

The differing receptions to the local project by the ENGAGE teacher community reflect different approaches to TRANSFORM in different country: in fact, in some countries the number of downloads of local TRANSFORM materials was much higher than expected.

The following paragraphs contain a schematic overview of one local TRANSFORM activity per country. Where available, a teacher comment relating either to a local or global activity is included, to highlight perceived features of the TRANSFORM materials.

Spain

- Local TRANSFORM theme: EXO planets
- *Dilemma*: Is it worth spending money in sending spatial missions to Exoplanets?
- *Local contact/resources*: Simulator of planets, astronomy association
- *RRI Skills addressed*: risks and benefits
- *Teacher comment on global TRANSFORM project "exterminate"*: "During this academic year, a group of teachers of biology, physics-chemistry and technology in my school want to devote some sessions of the course to carry out a project with an adapted group from 3ºESO. The objective is to learn by competences, by carrying out a project on the topic of mosquitoes. This resource seems interesting in our case - it is an issue that may interest students, because in our school we get quite a lot of mosquitoes. It would be an issue that affects them and in which to work to find solutions. The proposed contents would have to be adapted to the level of the classroom and would take a more applied point of view to analyse how to solve the problem of the school. The greatest challenge will be the multidisciplinarity of the project, as it will involve coordination among the three teachers".

Romania

- *Local TRANSFORM theme*: Cities of the Year 2050: smart cities based on unpolluted and renewable energy
- *Dilemma*: How long are we safe to use conventional energy resources?
- *Local contact/resources/stakeholder*: Researchers from Institute of Multidisciplinary Research for Science and Technology, Valahia University of Targoviste
- *Teacher comment*: "Starting from the premise that, in the near future, reserves of conventional sources of energy will not be able to meet the needs of man and society, the topic transposes the students into a very possible

dilemma situation, for which they must find realistic solutions. From the methodological standpoint, a particularly valuable worksheet for students is the game "Solar House". In the context of using this tool, students develop competencies resolution, and investigate identifying solutions to reduce consumption of electricity produced from conventional sources".

Cyprus

- *Local TRANSFORM theme*: Using blood tests to identify genetic abnormalities to embryos
- *Dilemma*: Is it ethical to decide on whether an embryo should be terminated or not?
- *Local contact/resources/stakeholder*: People from the Department of Human Biology, and scientists from the Institute of Genetics and Neurology Cyprus who have created the blood test.
- *Implementation*: Two of the researchers in our group worked closely with the scientists and the teachers, and the teachers were supported both during the design and implementation of the project. For part of the implementation one of the researchers was present in the class.
- *Teacher comment*: "I believe that the topic that was chosen is very interesting and timely. This new test that the researchers at the Institute of Research and Neurology have designed is non-invasive on one hand, but has not been used widely yet. Therefore through this topic I can discuss with my students the ethical aspects of deciding whether to terminate a pregnancy or not, band also discuss how medical tests are validated".

France

- *Local TRANSFORM theme*: Feed the World
- *Dilemma*: Should we change our feeding habits to preserve the future of the planet?
- *Local contact/resources*: support teachers to find the contacts.
- *RRI Skills addressed*: Examine consequences, Communicate ideas.

Norway

- *Local TRANSFORM theme*: Plastic waste in Norwegian coastal areas and its impact on ocean life. Main sources of waste, methods for removing, possible political actions.
- *Dilemma*: Traditionally most of the plastic waste found in Norwegian waters is carried by the ocean currents from other countries (England, the Netherlands, Denmark). However dangerous pollution from microplastics (from cosmetics, clothing and even football fields) is increasing rapidly, and may call for new actions on a regional, local or even personal level.
- *Local contact/resources/stakeholder*: The Norwegian coastal administration, Norwegian Environment Agency, Vesar recycling.
- *Implementation*: We provided personal guidance by email, as well as a personal meeting with the teachers at their school for two of the three schools. In addition, we asked the teachers to use our TRANSFORM MOOC buffet to exchange experiences with the other TRANSFORM teachers, but they did not do so.
- *Teacher comment* on global material "Exterminate": "I recently started this project (Exterminate!) in a 10th grade class, and it has been very engaging! The students were strongly engaged by the PowerPoint introduction, and discussions were lively. They worked through the KWHL grid, and everybody managed to write down questions they felt needed to be answered in order to make a decision. The Game of Life was successful too, offering a good model of what might happen if you remove something from the food chain".

http:// EngagingScience.eu

UK

- *Local TRANSFORM themes:* 1. A project version of "Man or Machine", with the support of an engineer. 2. A version of "Exterminate" for teaching the whole 'interdependence' topic, with email/video support from scientists.
- *Dilemma*: 1. What make cyclists go faster? Should some designs be banned because they give an unfair advantage? 2. Should we exterminate all mosquitoes?
- *Local contact/resources/stakeholder*: Both these projects were developed in conjunction with teachers.
- *Implementation of local resource and global project:* Email and telephone support in implementation and preparing a project presentation. A teacher from each project is presenting at the UK ENGAGE conference.

Lithuania

- *Local TRANSFORM theme*: Firefighter 2.0. E-textile usage benefits and risks
- *Dilemma*: is it possible to use e-textile in the production of cloths (not only for firefighters)?
- *Local contact/resources/stakeholder*: The Lithuanian team used mailing campaigns for in-service teachers. Dissemination of the events and other TRANSFORM-phase-related information was carried out with the help of Lithuanian Biology Teachers Association and Lithuanian Centre of Non-formal Youth Education.
- *Implementation*: During the MOOC, participating science teachers were introduced to global TRANSFORM projects, and they analysed their structure. At least 7 teachers tried Exterminate or Eco-phones materials. Teachers under the supervision of Prof. P. Pečiuliauskienė and consultant Dr. I. Kepalienė (Department of Technology and Technological Education) created the local TRANSFORM project 'Firefighter 2.0', describing the dilemma regarding e-textile usage benefits and risks, and at least 5 teachers practiced it with their students.
- *Teacher comment on global material "Exterminate":* "Today we had the second lesson regarding the Exterminate teaching material. I agree that it is not enough to have 2 lessons for the material to be realised, but I am happy that the students performed and presented all the given tasks. Such lessons bring "new winds". All students voted that they need such type of lessons in the future".
- *Teacher comment on global material "Ecophone":* "I tried the material before winter holidays. Students liked the theme. At first they thought that the task is quite easy, but later on they asked to extend the time for its preparation after holidays. I got the finished task of one student on the 31st of December, 2016. It showed that the will to get more information won against the holiday time".
- *Teacher comment on local material:* "Students were introduced to the dilemma: is it possible to use e-textile in the production of cloths (not only for firefighters). The students tried to formulate the research questions. The students played a game in order to understand the role of e-textile, and they exchanged the gathered information. The students gathered facts in order to proof their own decision regarding the dilemma. Such a new type of lesson was very interesting for the 9th grade students".

Greece

- *Local TRANSFORM theme*: Vaccines: For or against?
- *Dilemma*: According to a recent worldwide survey, 1 out of 4 Greek people are sceptical on vaccines, & Europe is the continent in which people are most sceptical about vaccines. Recent news releases make reference to a new "anti-vaccine" movement, which becomes bigger and bigger due to unreliable information on the web. Parents become sceptical on whether they should vaccinate their kids. Students are asked to review resources, evaluate their reliability and advise parents on the dilemma: For or against vaccines?

- *Local contact/resources/stakeholder*: The material was co-produced by the Greek ENGAGE team, 1 science and 1 language teacher, and the cooperation of biologists/researchers and medicine researchers.

Switzerland

- *Local TRANSFORM theme*: The comeback of the wolf to the Alp region
- *Dilemma*: Fight it or tolerate it?
- *Local contact/resources/stakeholder*: There is an ongoing exhibition in the Fribourg Museum about the wolf.
- *Implementation*: meeting with a scientist (Suzanne Lommen), for the "Invasion" resource; workshop in July 2016, to guide teachers to carry out a project - this led to the "Wolf project", presented on March 15th.
- *Teacher comment on local material INVASION: "*By initiating discussions between students, they are made to work on socialisation as well as the ability to argue. The confrontation with different and unexpected opinions opens the minds of the students to other answers, from other points of view. The absence of a definite yes/no answer can cause frustration among young people who often expect a clear answer from the teacher, but at the same time they understand that life is not just black or white. There is mainly grey (much more than 50 shades only) ... The activity also generates frustration because we would like to know more than the documents provided tell us. We would like to be able to do research to build up a solid opinion that can defend itself."

Online courses (MOOCs)

All countries developed online or on-site activities to support TRANSFORM teachers. In some cases, MOOCS were highly linked with local TRANSFORM projects; in other cases they followed the same scheme as in the previous phases of the project.

TABLE 5: NUMBER OF REGISTRATIONS ON MOOC COURSES BY COUNTRY

Country	Registration
Germany	14
UK	
France	18
Spain	35
Romania	41
Greece	49
Israel	
Norway	15
Switzerland	16
Lithuania	15

Cyprus	31

UK and Israel adopted an open self-help model - without registration; teachers participated in webinars, google hangouts, accessed slides, guidelines, downloaded the course book and video clips about TRANSFORM.

RRI festivals

All countries organised a final event allowing engaged teachers to meet; presenting results of local TRANSFORM projects, and discussing open schooling and innovative pedagogies, as well as RRI topics related to science education.

FIGURE 29: IMAGES FROM RRI FESTVALS

T6.4 Mentoring to support transformed practice

This task, led by VUT, aimed to: Identify new teachers, and recruit and train 'TRANSFORM'-qualified teachers as mentors for online community.

In the TRANSFORM phase, the partners had multiple options to organise the activities in their country. The criteria used for identify new teachers were:

(a) having a lot of experience in teaching science;

(b) involvement in other projects related to science teaching or RRI;

(c) achievement of CPD programmes related to modern teaching strategies (IBSE, PBL, using virtual experiments in science teaching etc.);

(d) being mentors in other programs at national level. The partners have identified new mentors during TRANSFORM activities and recruited them by direct personal contact, in general, and through different stakeholders, in particular.

The mentors were trained in different ways, depending on country:

(a) by providing a mentoring guide developed especially for them (e.g. Spain);

(b) by providing materials related to pedagogical tools that were used during ADOPT and ADAPT stages and ENGAGE methodology (e.g. Lithuania);

(c) in the frame of an online course by learning how to develop new TRANSFORM projects (e.g. Romania);

(d) using a short workshop (few hours) to discuss issues from TRANSFORM and what kind of support that the teachers might need (e.g. Cyprus).

As an example, in the case of Romania all the teachers who were invited to participate in online course ADOPT-ADAPT were teachers with experience in teaching sciences, and they had previously participated in one or more projects related to IBSE, RRI or introducing virtual experiments in classroom. Only teachers who completed the online course ADOPT-ADAPT were invited to attend TRANSFORM online course, where they learned how to develop and run a TRANSFORM project. All teachers that completed the TRANSFORM course are qualified as TRANSFORM phase mentors.

As TRANSFORM activities were carried on in the last months of the project, the evidence of mentoring activities comments in the Knowledge HUB. Figure 30 presents the number of comments in the Knowledge HUB, distributed per language. Cyprus and Switzerland are listed as separate categories as these countries had their own sites, despite using the same languages as the Greek and French sites respectively. In another perspective, the trained mentors will be active members of the ENGAGE online teachers' community after the project end, during the sustainability period.
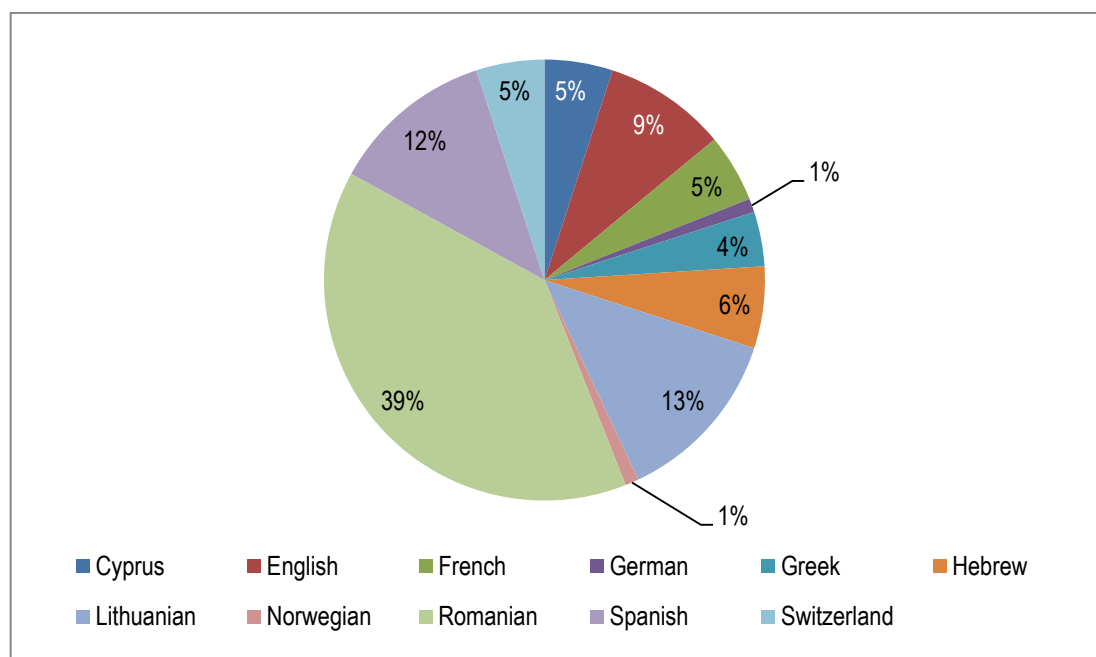

FIGURE 30: NUMBER OF COMMENTS IN KNOWLEDGE HUB PER LANGUAGE

Resources
TRACES, the coordinating partner of WP6, invested more time to TRANSFORM phase than initially estimated. This was due to the challenges of developing a complex aspect of the project to share across all partners.

Partner	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
	SHU	OU	FORTH	FAU	ELS	TRACES	VUT	WEIZMAN	UB	HSN	TU Delf	DICS	LIETUVO	UNic	
Person months - Total for the Project (annex1)	4.5	0	4.5	4.5	0	7	3	3	4.5	3	0	3	3	3	43
Estimated for the 1st 18 months	0.00	0.00	0.00	0.00	0.00	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	1.50
Actual for the 1st 18 months	0	0	0	0	0	1	0	0	2	0.01	0	0	0.00	0	3.01
Estimated for months 19-39	4.50	0.00	4.50	4.50	0.00	5.50	3.00	3.00	4.50	3.00	0.00	3.00	3.00	3.00	41.50
Actual for months 19-39	3.2		4.5	4.5	0	10.5	3	3.5	3.3	1.5	0	3.2	3.55	2.9	43.65

3.7 Work Package 7 - Legacy

This Work Package was led by the Open University (UK). The goals of this Work Package were to:

- disseminate the project including outcomes and case studies to other groups of stakeholders
- develop strategies for promoting widening awareness and impact during and after the project, for promoting sustainability for the ENGAGE project
- produce RRI Festivals of best practice

WP7 produced several significant results:

The ENGAGE project reached a large number of institutions responsible for formal and informal learning; for example data from the ENGAGE Portal in English shows that ENGAGE materials reached various organisations apart from secondary schools such as: girls' academy; science club; science centres; NHS (national health service); STEM associations; Team up science companies; Singapore and Peru Ministry of Education; Special Centre Associations; community learning networks, and home schools. Data from the project websites show that materials have been downloaded from more than 80 countries. For instance the ENGAGE website in English has members from the UK, Australia, Canada, USA, New Zealand, South Africa, Ireland, and international schools (English speakers) from almost all countries in Europe and various across the world such as Brazil, China, Japan and India.

FIGURE 31: ENGAGE – MEMBERS ACROSS THE WORLD – 80 COUNTRIES

Comments from users:

*"Resource very useful; it requires students to reflect on the progress of biology techniques and **evaluate the pros and cons** of its use."*
Material: **GM Decision** used on 16 March 2016 in **Portugal** Coimbra

*"My students have enjoyed this activity over 2 lessons. They have combined this with PSHE lessons to make a huge impact on their **making decisions** skills. Thank you for this thought-provoking activity."*
Material: **E cigarettes** used on 10 December 2016 in **China,** Qingdao

*"Your resources are extremely useful! I think they are very appropriate to cause some **responsible thinking**!"*
Material: **Breaking News: 3 Parents** used on 10 December 2016 in **India,** Mumbai

*"Before becoming a teacher, I worked in **biomedical research** at my local medical university. I worked on Salmonella typhi or Typhoid Fever. Using a mouse model to study the extent and progression of the invasion of the bacteria is absolutely necessary, unless you know some humans willing to ingest typhoid for testing! We were working on a new vaccine. I support this kind of animal testing 100%"*
Material: **Animal Testing** used on 14 December 2016 in **South Africa** Cape Town

*"I and my group of graduate students in science education at Unesp - São Paulo State University (Brazil) welcome this report, and considered such an initiative of exploring science education linked to **RRI principles** through pedagogical approaches of **socio-scientific issues** very timely. In fact, it seems that similar concepts of RRI are flourishing around the world, including programmes such as Pibid, in Brazil, which also encourages schools to engage in **social projects**. We will surely benefit from the report insights, which in a way respond to what we expect in terms of defining learning outcomes."*
Material: **Innovative Teaching for RRI report**, used on October 2016 in **Sao Paulo Brazil**

Objective 1: dissemination of outcomes

FIGURE 32: INTERNATIONAL CONFERENCE ENGAGE WORKSHOP IN OXFORD MORE THAN 60 TEACHERS 2016 PRESENTED BY SHEFFIELD HALLAM UNIVERSITY

Task: RRI Seminar and Experts meeting

Objective 2: wide awareness and sustainability

Task: dissemination of ENGAGE outputs in various events:

3.7.1 Open Multilingual Educational Portal

As already noted the ENGAGE website will remain live until 2020, creating a legacy for the project.

3.7.2. Scientix and Social Media

After 2020 the resources will be able to be moved to Scientix http://www.scientix.eu/ and Slideshare http://www.slideshare.net

In addition, ENGAGE MOOC will be transferred to OpenLearn Works (http://www.open.edu/openlearnworks) and Course Books and Reports can all be published at the OU ORO (Open repository of online publications)

Objective 3: Communication of Best Practices

Task 1: RRI festivals

The ENGAGE consortium organised 11 National festivals in Europe from January 2017 to March 2017 (Table 6), with target groups including stakeholders and end-users for knowledge exchange. Their aim was to mainstream the project outputs nationally to ensure large-scale dissemination, knowledge exchange and new strategies for keeping it sustainable.

RRI festivals in Lithuania and France with the average of 50 teachers

RRI festival events

TABLE 6: RRI FESTIVAL EVENTS

Partner	Event Title	Location	Date
Cyprus	Science festival	UClan University	09/12/2016
	Making science relevant	University of Nicosia	11/03/2017
France	Pédagogies actives en classe de sciences	Pierre-Gilles de Gennes Science center	03/02/2017
Germany	TBC	TBC	TBC[2]
Greece	ENGAGE-ing science RRI event	Foundation for Research and Technology, Heraklion	04/03/2017
Israel	Science festival regional and national conferences	Center conference in Davidson Institute, Weizmann Institute	21/02/2017
		North Conference, Carmiel	28/02/2017
		South Conference, Beer-Sheva	14/02/2017
		Weizmann Institute of Science	21/03/2017
	Science teachers' festival	Weizmann Institute of Science	13/03/2017
Lithuania	RRI festival: ENGAGEment in science	Lithuanian University of Educational Sciences	27/01/2017
Norway	Engaging science festival	University College of Southeast Norway	23/03/2017
Romania	RRI festival	Valahia University of Targoviste, International Conference Center	03/03/2017

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[2] RRI event Germany to be held outside of delivery period at partner expense

Spain	RRI in science education symposium	Universitat de Barcelona	23/02/2017
Switzerland	Enseigner les sciences au XXIe siècle: quels enjeux?	HEP PH Fribourg	15/03/2017
UK	Engaging science mastery	The Open University, Milton Keynes	11/03/2017

Resources

As coordinating partner of WP7, the OU team spent the most resource on this area

Partner	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
	SHU	OU	FORTH	FAU	ELS	TRACES	VUT	WEIZMAN	UB	HSN	TU Delf	DICS	LIETUVO	UNic	
Person months - Total for the Project (annex1)	5	9.5	3	2	1	2	1.5	1.5	2	1.5	1	1.5	1.5	1.5	34.5
Estimated for the 1st 18 months	1.25	2.38	0.75	0.50	0.25	0.50	0.38	0.38	0.50	0.38	0.25	0.38	0.375	0.38	8.63
Actual for the 1st 18 months	0.2	1.3	0	2	0.34	1.2	0.25	0	1.28	0.09	0	0.41	0.30	0.8	8.17
Estimated for months 19-39	3.75	7.13	2.25	1.50	0.75	1.50	1.13	1.13	1.50	1.13	0.75	1.13	1.13	1.13	25.88
Actual for months 19-39	1.5	9.57	3	2.03	0.36	1	1.28	1.5	0.77	1.62	1.5	1.2	1.20	0.71	27.24

3.8 Work Package 8 – Evaluation

This Work Package was led by TU Delft (the Netherlands). The objectives of this Work Package were:

1. To undertake internal evaluation activities of the implementation of the 'ADOPT', 'ADAPT' and 'TRANSFORM' programmes
2. To report on the participation and impact on teachers and students against project targets.
3. To report on stakeholder engagement and influence.

See the separate evaluation report for methods and results.

WP8 produced several significant results:
- ENGAGE materials were evaluated at several stages (pilot evaluation, first and second administration of the evaluation survey, pre- and post-tests).
- Evaluation of face-to-face workshops in all ENGAGE implementation countries (11 countries) were done.
- Evaluation of MOOCs was done at several stages (pilot, ADOPT & ADAPT) in all ENGAGE implementation countries.
- Several impact studies were done to investigate the impact on teachers, students and other stakeholders from different perspectives.
- International PCK evaluation planned, guided, and completed with 5 ENGAGE countries.
- Internal and external evaluators collaborated closely.

Internal Evaluation Studies

The internal evaluation activities from the beginning of the project are presented in table 7 below.

TABLE 7: INTERNAL EVALUATION STUDIES

Evaluation Aim	Method/Instrument	Period
Evaluation Framework and plan	Plan	Jun 2014
Classroom testing	Observation, interview, questionnaire	May-Aug 2014
Pilot evaluation –Materials	Online survey (Survey Gizmo)	Dec 2014-Apr 2015
Materials Evaluation	Online survey (Survey Gizmo)	Apr 2015-Nov 2015
Materials Evaluation -2d administration	Online survey (Survey Gizmo)	Dec 2015-Aug 2016
Workshops Evaluation	Questionnaire (pen & paper)	Oct 2014-Dec 2016
Pilot evaluation- MOOC	Online survey (EdX)	Jun 2015
MOOCs evaluation	Post-course survey	Oct 2015-Jan 2017
Impact evaluation -Dimensions of change	Pre-and-post-test design, dimensions of change model	Jan 2016-Mar 2017
Teacher impact evaluation- Case studies – ADOPT & ADAPT	Case study template	Jun 2016-Feb 2017
Teacher impact evaluation- Case studies – TRANSFORM	Case study template	Jun 2016-Mar 2017
Teacher impact evaluation- PCK research	Lesson preparation form, Lesson reflection form, Observation table	Feb 2015-Mar 2017 (including pilot)
Student impact evaluation – Student engagement	Time on-task methodology	Feb 2015-Apr 2016
Student impact evaluation	Learner report, Questionnaire, Case study	Sep 2016-Mar 2017
RRI festival evaluation	Survey (pen & paper)	Jan-Mar 2017

External Evaluation Studies

The external evaluation activities from the beginning of the project are presented in table 8 and table 9 below.

TABLE 8: EXTERNAL EVALUATION STUDIES

Activity	Country	Month 30/31 June/July 2016	Month 38 Feb 2017
OVERALL			
Partnership working	All	Observation of Romania meeting and interviews with partners	Brief questionnaire for partners to complete
Assessment of whether objectives and milestones met	All	Review of knowledge hub, work package reports and internal evaluation reports	Review of knowledge hub, work package reports and internal evaluation reports
Management of the project		Observation of Romania meeting and interviews with partners	Brief questionnaire for partners to complete
IMPACT ON STUDENTS			
TRANSFORM	UK Romania	F2F interviews (baseline)	Online questionnaire (impact)
TRANSFORM	All	Local evaluations/internal evaluation report	Local evaluations/ internal evaluation report
ADOPT	All	Reports from WP leader and internal evaluation	Reports from WP leader and internal evaluation
ADAPT	All	Reports from WP leader and internal evaluation	Reports from WP leader and internal evaluation
IMPACT ON TEACHERS			
TRANSFORM	UK Romania	F2F interviews (baseline)	Telephone interviews (impact)
TRANSFORM	All	Local evaluations/internal evaluation report	Local evaluations/ internal evaluation report
ADOPT	All	Reports from WP leader and internal evaluation	Reports from WP leader and internal evaluation
ADAPT	All	Reports from WP leader and internal evaluation	Reports from WP leader and internal evaluation
IMPACT ON STAKEHOLDERS			
Scientists	UK	F2F interviews (baseline)	Telephone interviews

	Romania		(impact)
Central government education department	UK Romania	F2F interviews (baseline)	Telephone interviews (impact)

TABLE 9: EXTERNAL EVALUATION STUDIES-PART II

Activity	Country	Month 30/31 June/July 2016	Month 38 Feb 2017
Curriculum standards agencies	UK Romania	F2F interviews (baseline)	Telephone interviews (impact)
Initial Teacher training institutions	UK Romania	F2F /telephone interviews (baseline)	Telephone interviews (impact)
Organisations responsible for CPD	UK Romania	F2F/ telephone interviews (baseline)	Telephone interviews (impact)
Media outlets	UK Romania	F2F/ telephone interviews (baseline)	Telephone interviews (impact)
Industry	UK Romania	F2F/ telephone interviews (baseline)	Telephone interviews (impact)
All the above	All other countries	Data via partners	Data via partners
To identify the facilitators and barriers to the take up of RRI by exploring what works, for whom and under what circumstances	5 countries: UK, Romania, Germany, Cyprus, Spain	F2F of partners in Romania	Follow up telephone interviews
LEGACY			
To identify the legacy of ENGAGE overall and in each country	All		Review of data collected and recommendations for further action to ensure sustainability in partner countries

| Cost benefit analysis | | Need to develop crude indicators | |
| Impact on non-partner countries | | | Data from partners |

Objective 1: Internal evaluation of ADOPT, ADAPT and TRANSFORM implementation

This objective is successfully achieved.

Materials Evaluation: 729 responses

Workshop Evaluation: 368 responses

MOOC Evaluation: 300 responses

Case Study: 28 cases, 652 students, 26 teachers

RRI Festival Evaluation: 11 events
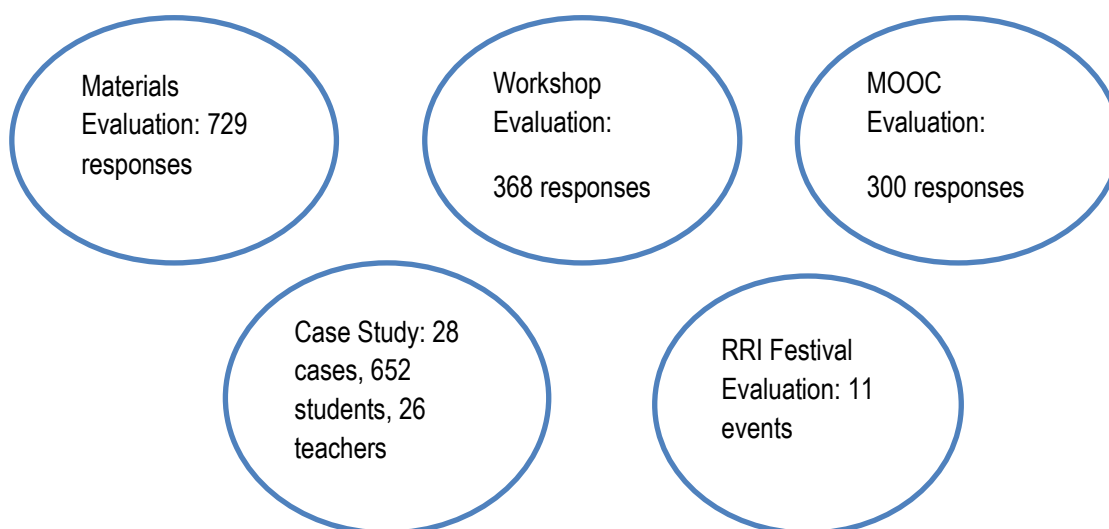
Objective 2: report on the participation and impact on teachers and students

T8.2. Evaluations on the impact on teachers and students

Positive shift in 5 dimensions of practice

PCK improvement

Changed teacher practice: 27 case studies
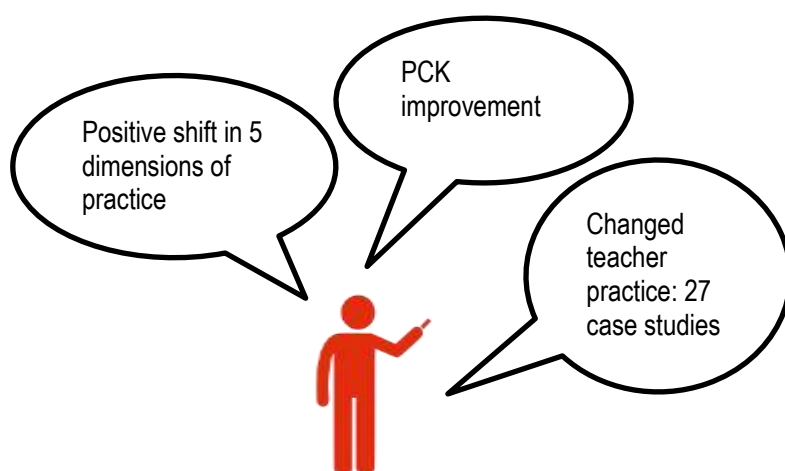
Teacher Impact

Student Impact

This objective was successfully achieved. The planned teacher impact research was done, and some extra evaluation studies were even carried out, to get deeper and better understanding of the impact of the ENGAGE programme on teachers who are our main target group.

Objective 3: To report on stakeholder engagement and influence

T8.3 Evaluations on the influence on other stakeholders: This task was carried out by the external evaluator – see Appendix: Report by Independent Evaluator

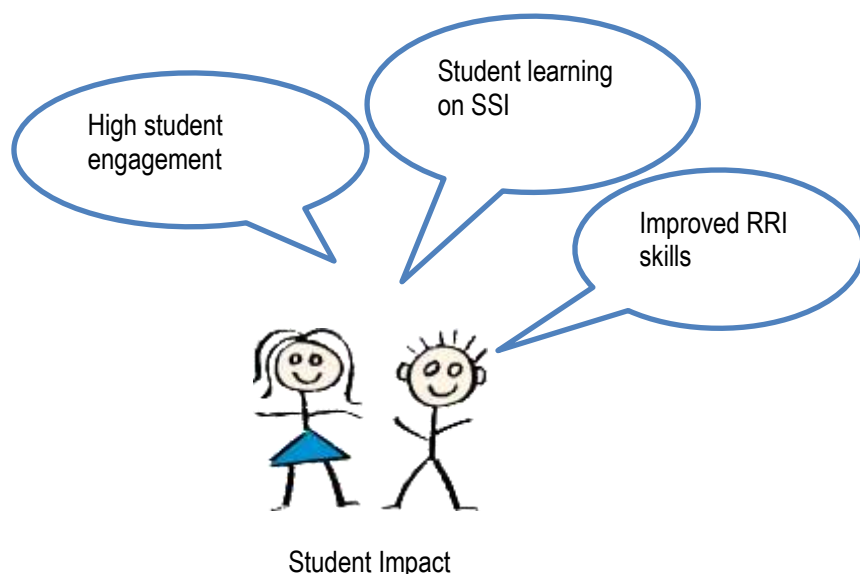*T.8.4. Independent evaluation-External evaluation - This task was carried out by the external evaluator – see Appendix: Report by Independent Evaluator*

T8.5 Report on project results and targets with recommendations: This task was carried out by the external evaluator – see Appendix: Report by Independent Evaluator

Use of Resource

As shown in Table 10 below

TABLE 10: PROJECT USE OF RESOURCES

Partner	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
	SHU	OU	FORTH	FAU	ELS	TRACES	VUT	WEIZMAN	UB	HSN	TU Delf	DICS	LIETUVO	UNic	
Person months - Total for the Project (annex1)	0.5	0	0.5	0.5	0	0.5	0.5	0.5	0.5	0.5	14.5	0.5	0.5	0.5	20
Estimated for the 1st 18 months	0.25	0.00	0.25	0.25	0.00	0.25	0.25	0.25	0.25	0.25	7.25	0.25	0.25	0.25	10.00
Actual for the 1st 18 months	1.5	0	0	0.25	0	0.2	0.25	0	0.25	0.09	6.25	0.08	0.40	0.22	9.49
Estimated for months 19-39	0.25	0.00	0.25	0.25	0.00	0.25	0.25	0.25	0.25	0.25	7.25	0.25	0.25	0.25	10.00
Actual for months 19-39	1.7	0	0.5	0.25	0	0.5	0.25	0.4	0.3	1.15	9.56	0.4	0.25	0.28	15.54

4. PROJECT MANAGEMENT DURING THE PERIOD

Sheffield Hallam University (SHU) was the Project Coordinator. Management tasks across the project fell into Work Package 9, with SHU recording time against this work package for both coordination and national management responsibilities.

Management activities

The team at SHU was responsible for management of all tasks to ensure high quality in the delivery of the consortium, the project activities, deliverables and progress towards targets as well as the finances and project administration. All partners also had a management component to support this activity.

Objectives

- Coordinating Partner (partner 1) to oversee the successful running of *ENGAGE* across all partners
- National implementation of *Engage*
- Regular networking with all partners
- Administration of project and financial management of national budgets
- Management of project deliverables
- Completion of project milestones

The Coordinating Partner led the Project Steering Group, which was made up of representatives from key partners (SHU, Weizman, FORTH, TRACES, OU). The Steering Group was collectively responsible for:

- Ensuring all delivery deadlines/milestones were met
- Supporting the evaluation strategies, internal (WP8) and external
- Attending all progress and review meetings and submitting data to be included in all review meeting reports
- Keeping the project on track to realise its ambitions

Significant Results

All deliverables and milestones for months 19-36, revised following amendment No. 2, have been successfully met in the period. Regular networking and reporting procedures have been established to keep all participants up to date.

Methods of Communication

A blend of regular face-to-face and regular weekly term-time online team meetings, backed up by a project management platform ASANA, has enabled good progress to be achieved from months 19 to 39.   .

Project meetings, dates & venues

Face-to-face meetings are central to the project's development: those held to date and those taking part between months 19-39 are listed below In the external mid-term review, partner satisfaction with face-to-face meetings scored very highly with our external evaluation report.

TABLE 11: F2F PARTNER MEETINGS

Title	Date	Location / Host	Purpose	Involvement
(WP5) Adapt detail skills development content for teachers	6-7 July 2015	Open University, Milton Keynes, UK	To write intensively and collaboratively to ensure localisation and quality	Sub group meeting including WP3, WP5 and WP6 teams
WP5/6	27-29 October 2015	Weizmann, Israel	Review progress and plan next steps	All partners
Mid Term Review and Steering Board All WPs represented	8-9 December 2015	EC Brussels, Belgium	Mid term review meeting and F2F Steering Group meeting	Sub Group WP lead representatives
WP focus on 5/6/7/8	2-4 June 2016	Sinaia TUV Romania	Implementation of Transform planning for evaluation and legacy	All partners
WP focus on 6/7/8	6-7 February 2017	Sheffield Hallam UK	Project review legacy and a celebration of our achievements across all aspects of the project	All partners

Open University, Milton Keynes England – 6-7 July 2015 - WP3 development

This sub-group meeting was a result of a request from Greek and Israeli partners at the earlier all-partner meeting in Crete in May 2015. Although essentially a subgroup meeting , it was open to all partners and was an important opportunity to meet, given the strong cross-partner involvement with resource materials development (WP3) for WP5 (Adapt phase) and latterly WP6 (Transform Phase). As a result there was strong partner representation at this meeting, which was key to defining the future shape and development of resources so that they would satisfy all partners in terms of progress and direction.

The Accelerator Weizman Institute, Tel Aviv Israel – 27-29 October 2015

This whole-consortium meeting, hosted by the Israeli partner, was focused in particular on the development of WP5 and WP6. All partner organisations were represented and good progress made. A copy of the agenda from Asana is shown in figure 33 below:
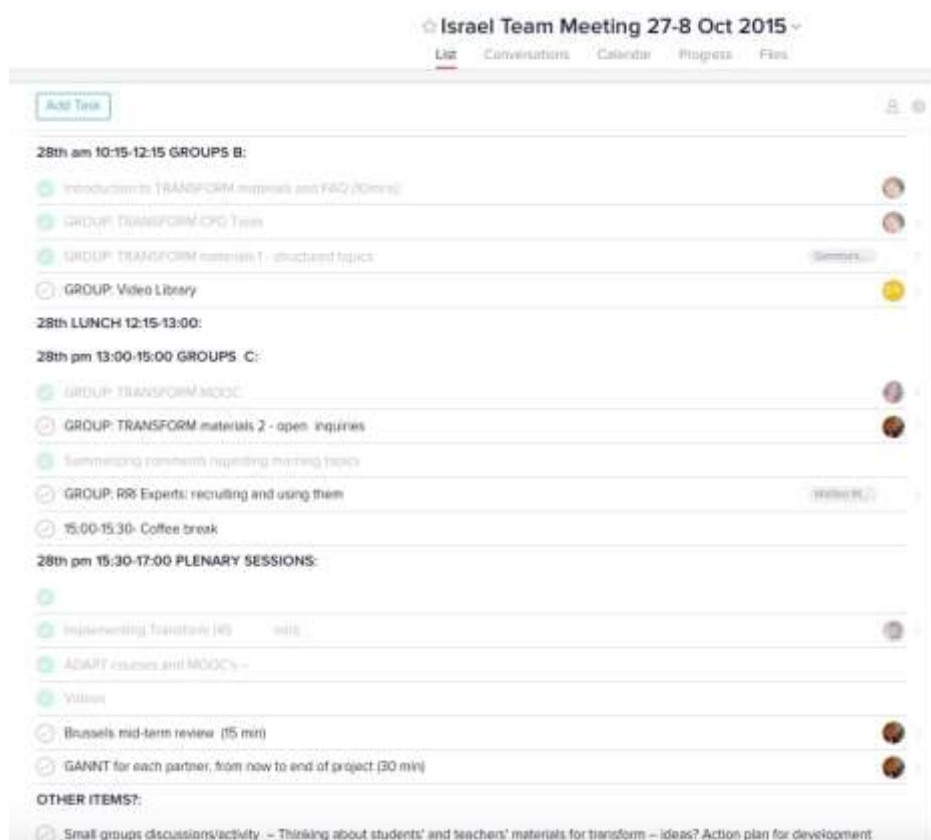
FIGURE 33: ISRAEL TEAM MEETING AGENDA

Brussels 8-9 December 2015 - Mid Term Review and Steering Board meeting

The steering group meeting was held in the EC offices on 8th December. Central to this meeting was discussing how we would manage resource if the project were to be given a three-month extension.

The mid-term review took place on 9th December; all Work Package Leaders were represented at the meeting. Overall the project progress was marked as satisfactory, with the technical report following the review making several recommendations:

1. *The consortium must come to a more common explicit understanding of RRI, which is an essential component of its activities, and which currently seems to be treated as synonymous with inquiry and argumentation. This understanding needs to be incorporated and highlighted in the design of materials and CPD activities. It should be based on current thinking about RRI, especially at EU level.*

   Resulting Action – The RRI aspect formed a focus, and was discussed at subsequent weekly online meetings. Deliverable D1.1 was revised and resubmitted, with the revision process being used to generate dialogue amongst partners as to what RRI meant to the project and how this could be articulated in terms of interactions with teacher stakeholders. In subsequent CPD, both F2F and MOOC, RRI was introduced explicitly at the forefront of the CPD and used as a discussion point to start ENGAGE CPD delivery. This was particularly strong in WP3, WP5 and WP6. As the resources developed through Adapt and into the Transform phase, the level of RRI congruence also increased.

2. *An advisory board as originally planned in the DoW, would support the consortium in integrating the RRI concept into the materials and activities.*

   Resulting Action - This was considered and explored as an option, but moved instead towards smarter communication across all partners with clearly defined goals. Changing both project manager in September 2015 and external evaluator in October 2015 also gave the opportunity to integrate the new evaluator more within the project, and enabled greater input at some online (and even face-to-face) meetings. The involvement of a new, knowledgeable, independent evaluator was an effective spur to the partners.

3. *The structure of some deliverables, and the overall deliverable structure, is confusing. There should be better separation of planning and reporting within and across documents. As the deliverables are publically available documents, there should be more attention to details such as formatting, and the avoiding of the use of individuals' names where these may be sensitive. In addition, it is important that the teaching and learning content of the project is fully documented and easily available via the website.*

   Resulting Action - the process of revising the rejected deliverables D1.1, D4.8, D6.11, D7.13 and D8.16 enabled us to take this into consideration so that it could better inform reporting of subsequent deliverables

4. *More transparency, and possibly a more conservative approach, would be helpful in assessing reported figures, e.g. for downloads, use of resources etc.*

   Resulting Action - going forwards from the mid-term review a regular progress update videoconference meeting was instigated, with work package leaders from WP4, WP5, and WP6 being given responsibility for gathering data in better coordination with the internal evaluation lead partner WP8. The website platform for WP2 was also developed further, and used to survey end users as to their thoughts and experiences. Particularly useful was the self-promotion tool used by teachers to move from the Adopt to Adapt phases, and thus unlock more resources by answering some simple resource use questions. In addition to this, an emphasis upon collecting more qualitative data from partners was driven by WP8 lead.

5. *A more analytical approach to the comments received regarding materials would be helpful.*

   Resulting Action - as per point 4

6. *The consortium should consider possible policy recommendations at National and European levels and to disseminate these well before the end of the funding period.*

   Resulting Action - With the support of the coordinating partner and external evaluator, who has experience within policy making area, partners were encouraged to plan for engagement with local and national organisations. Particular success was achieved in the UK (curriculum links) and Romania (national policy links).

7. *More consideration should be given towards planning the legacy of the project, especially in view of its reliance on online resources and learning communities.*

   Resulting Action - as per point 6

In addition to the above recommendations as already mentioned, a number of deliverables (D1.1, D4.8, D6.11, D7.13 and 8.16) were rejected and flagged for resubmission to the portal.

The project co-coordinator saw this as an opportunity to develop more coherent reporting styles for partners, in particular work package leaders. The five rejected deliverable reports were worked on collectively and this task was co-ordinated through the ASANA project management platform shown below in figure 34.
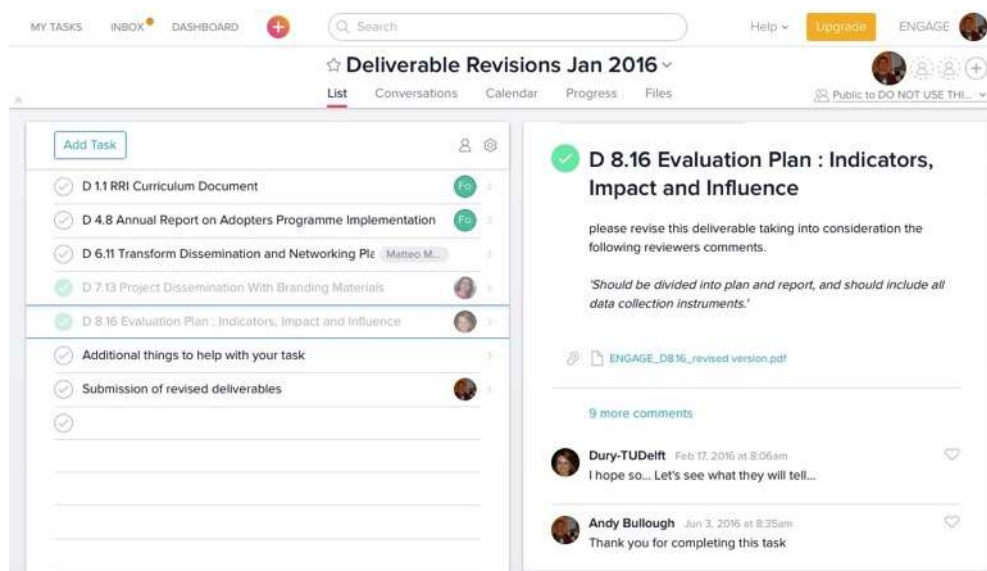
FIGURE 34: COORDINATION OF DELIVERABLE REVISION

Project Amendment Two

Following the Steering Group meeting in December, the ENGAGE consortium decided to apply to the EC for an extension to the project. ENGAGE delivery partners were finding it hard to move from embedding one phase of the model to the next. All phases were running slightly behind schedule, due to it taking time initially for all partners to familiarise themselves with one another and the project targets. The amendment would request three additional months. In addition to this, two other requests were made: the first due to our Norwegian partner merging with a new organisation, and the second a change of project manager from Pat Morton (who had retired) to Andy Bullough.

Subject: Request for Amendment No. 2 to grant agreement No. 6123269

- Project title "ENGAGE"

With reference to the above mentioned grant agreement, I request on behalf of the consortium to modify the grant agreement as follows:

a. Modification of duration

The duration of the project specified in Article 3 of the grant agreement is modified as follows:

New duration: 39 months

> **Modification of Annex I - Description of Work:** Annex I – Description of Work is modified.
>
> The revised Annex I dated 12.02.16 replaces any former version.
> All other provisions of the grant agreement and its annexes shall remain unchanged.
>
> **b. Universal Transfer of Rights and Obligations (UTRO)**
>
> Universal transfer of rights and obligations from HOGSKOLEN IBUSKERUD OG VESTFOLD to HOGSKOLEN I SOROST NORGE ("beneficiary no. 10") as of 1st January 2016
>
> Therefore, HOGSKOLEN I BUSKERUD OG VESTFOLD has modified its legal details as follows:
>
> **HOGSKOLEN I SOROST NORGE,** established in KJOLNES RING 56, PORSGRUNN, 3918, NORWAY, represented by Mr. Jan Petter Aasen, Rector and/or Dr. Mette Falck-Pedersen,
>
> Any reference in the grant agreement, including Annex I and the table of the estimated breakdown of costs, to Hogskolen I Vestfold (PIC 998911627)shall be deemed to be a reference to Høgskolen i Sørøst-Norge and is a member of the consortium identified in Article 1.1].
>
> Notwithstanding the transfer referred to above, the Commission and/or the European Court of Auditors and their authorised representatives shall continue to enjoy the rights referred to in Articles 22 and 23 of Annex II to the grant agreement in respect of work undertaken by Hogskolen I Vestfold which shall continue to be bound by the provisions of the grant agreement and its Annexes relevant to the effective exercise of these rights.
>
> **c. Change of coordinator's name and address**
>
> The address specified in Article 8.1 of the grant agreement is modified as follows:
>
> For the *coordinator:* Mr. Andrew Bullough
>
> SHEFFIELD HALLAM UNIVERSITY Centre for Science Education HOWARD STREET SHEFFIELD SI 1WB UNITED KINGDOM

Other project changes

In September 2015 the original external evaluation organisation, CEIR, was merged with the co-ordinating partner CSE (SHU). As a result of this, and to avoid a conflict of interests, Pat Morton took the decision in her last action as PM to openly advertise the external contract work within the subcontractor aspect of the SHU co-ordination role. Following an interview in October 2015 Dr Stella Mascherenas-Keyes was appointed by the new PM Andy Bullough, and took up the role of external evaluator.

A challenge for partners

As a consequence of the amendment request, coupled with the change in name for the Norwegian consortium partner and project manager change mid-way through the project, there was a negative impact on the financial claim and reporting period 1 for the project. This was a particular challenge for our French and Italian partners, who both are both

Small Medium Enterprise organisations. However, the amendment was processed swiftly by the EC and the resulting financial payment sanctioned quickly by the project officer and financial officer respectively.

FAO : EU Engage Project Officer

I am writing to you on behalf of the ENGAGE consortium of partners to express our concerns over the delays to partner payments following the first round of financial reporting opening in June 2015.

On Tuesday 17th of May we held an extraordinary partners meeting at the request of our Italian partner who had proposed the following motion.

On behalf of my Company I ask you please to organize and participate to an extraordinary Steering Committee meeting to decide on closing and sending the 1st FS without the missing data from (HBV). The 1st FS should have been closed almost one year ago, and it is not closed yet although most of the partners provided the requested data in the due time. At this point, we believe it's fair for those partners that worked and submitted the FS 10 months ago to receive the related payments a.s.a.p. especially when they are not large organizations and this delay in payment could impact on their financial balance.

11 partner consortium members attended the online FM meeting. I have included our minutes as an appendix to this letter. After discussion around the various problems that have contributed to the payment issue namely that the Norwegian partners form 'c' has remained in an inaccessible space due to it being associated with a previous organisation name. It was decided that we should continue to submit our form c's as a whole for financial reporting including the Norwegian partner. As this is the only realistic option open to us.

We are aiming for the Norwegian partner to be able to submit their form c's on the portal providing the online access changes have been made early next week.

This still leaves a problem in that once submitted by the project manager / coordinator at SHU that the time for payment to be made can take up to 90 EU working days from the reporting date.

What we are seeking from you is some written assurance that this payment processing can be expedited.

We would also like you to consider if there are any additional pre financing options available from the EU so that the coordinating organisation (SHU) could make intermediate payments to the partners most in need. This includes the two small medium enterprises one of which is currently taking up a bank loan and the second one whose work on the project is mostly front-loaded. In addition some of the universities that we are working with do not have the facility to work in a negative financing model with retrospective payments.

Yours sincerely

Andy Bullough project manager on behalf of the ENGAGE consortium of partners

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Subsequent Deliverable reporting changes

As a result of the changes of amendment 2 and through negotiation with the project officer it was agreed that a range of deliverables in particular in relation to WP4, WP5, WP6, WP7 and WP8 could be given longer to report. This gave partners a better chance to reflect on achievements and progress needed.

Sinaia Romania June 2nd and 3rd 2016

Hosted by the Romanian partners (VUT), this meeting concerned planning for the implementation of the Transform Phase (WP6) whilst also reflecting upon aspects of legacy and evaluation progress (WP7/WP8).
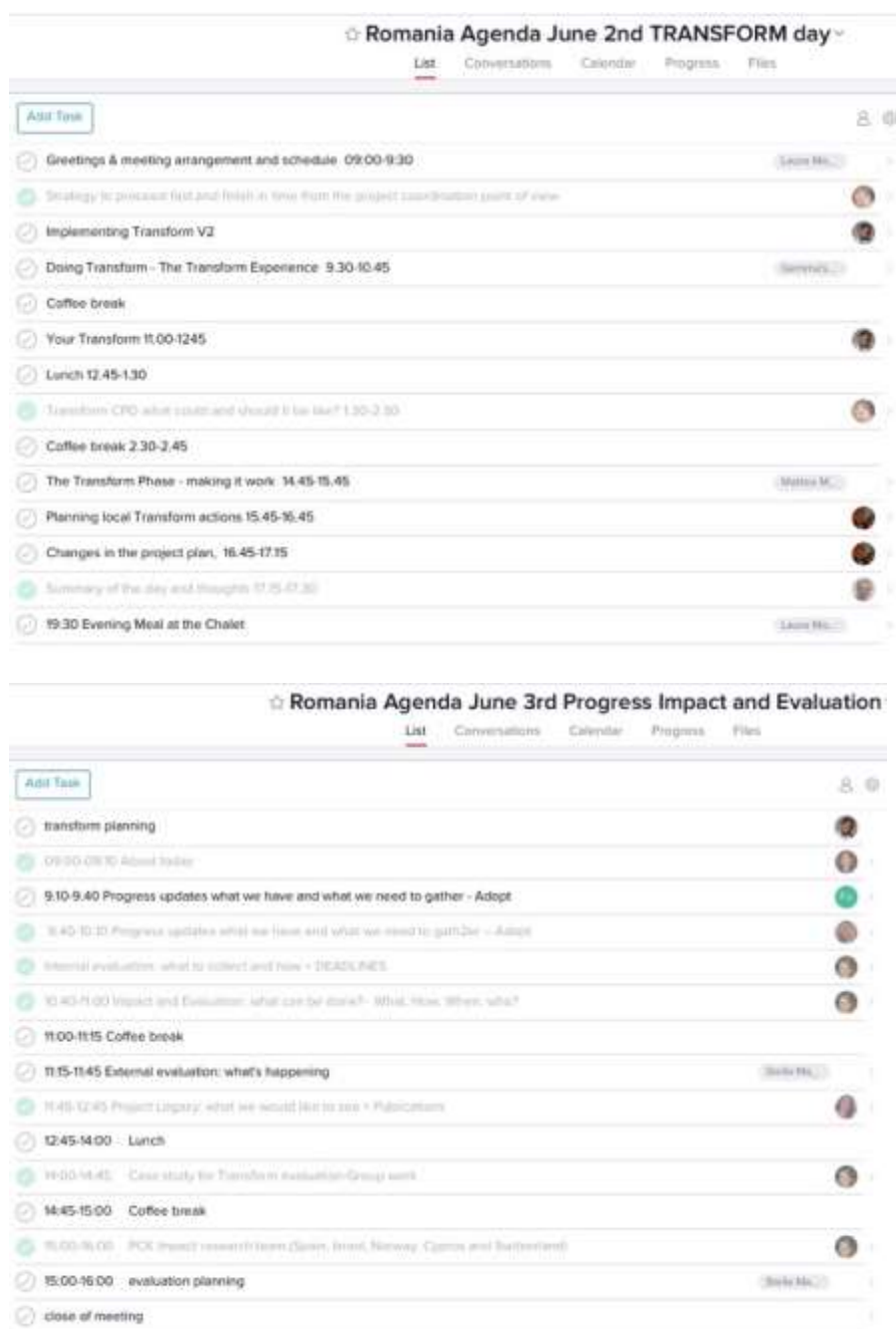
FIGURE 35: AGENDA FROM ROMANIA MEETING

Weekly progress meetings and use of technology

Change management months 19-39

In addition to the regular online meetings, and following a suggestion from our external evaluator, the scientific officer Tony Sherborne re-briefed all partners via individual conversations during month 33 as to how to achieve and reach the expected goals. Agendas and planning were developed jointly using the ASANA online platform. This provided a focus and partner buy-in for a complex project.

Sheffield Hallam University – United Kingdom- February 6 – 7 2017

This meeting was a celebration of our achievements, whilst focusing upon future legacy and taking into consideration smooth period 2 reporting.

7th FEB TUESDAY AGENDA:

- 9.00am Impact evaluation part 1
- 9am Impact evaluat 1 ♥
- 10.00 am Exploitation & evaluation 1:1 clinics
- 11.00 am Website legacy
- 11.30 Publishing outputs
- 12pm Completing Engage
- 12.30pm Project Management Financial admin
- 1pm Finish formal sessions
- Working LUNCH

FIGURE 36: SHEFFIELD PARTNERS' MEETING AGENDA

Our Team

Notable Partner Resource Issues for final claim

As a result of amendment two partners (UB (Spain) and LiEU (Lithuania)) requested to bring CPD delivery "in house" instead of subcontracting as it would be more cost-effective. The coordinating partner agreed to this, and shared the

potential for this cost-saving measure with other partners as a good approach to coping with increased project length without additional funding.

Towards the end of the project one partner, HSN (Norway), alerted the coordinating partner to an underspend, as a result of their CPD MOOC needing less resource investment than anticipated. In contrast, two partners reported a difference in resource commitment than originally indicated; i.e.

ELS (WP2) had committed more time to the Web development than initially anticipated. A great deal of effort was put into realising the web potential and presence of ENGAGE. Indeed, at the mid-term review the website was identified as a strength of the project. The final website is central to the international award that was won for Open Education accessibility in 2017. To achieve this, ELS made many adaptations and fixes to continually improve the quality of the ENGAGE website.

TRACES for different reasons found that they had a much larger resource commitment than originally planned for. TRACES explained the main issues stemmed around CPD and development work needing much greater investment than anticipated.

The RRI conference organisation and hosting for the UK was transferred from SHU to the OU and held in Milton Keynes in March 2017.

Additional and amended FC1 claims at FC2

As part of the Form C 2nd period adjustments have been made to the claims from FAU (Germany) €6,452 and SHU (UK) €2,187.

Audit

As part of the project financial reporting process we comissioned an independent external audit report from Grant Thornton cahrtered acountants UK. No exceptions were noted and the form 'c' from Sheffield Hallam University was deemed to be in accordance with FP7 financial reporting protocols. This report is uploaded as a separate document.

Comment on allocation of resource To WP9

Considering the additional three months of the project the management aspect of ENGAGE was slightly over that initially predicted for months 19-39, with 2.38 additional person months of resource across all partners.

Partner	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
	SHU	OU	FORTH	FAU	ELS	TRACES	VUT	WEIZMAN	UB	HSN	TU Delf	DICS	LIETUVO	UNic	
Person months - Total for the Project (annex1)	15	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	21.5
Estimated for the 1st 18 months	7.50	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	10.75
Actual for the 1st 18 months	12.4	0	0	0.25	0.37	0.15	0.22	0.25	0.25	0.78	0	0.3	0.30	0.2	15.47
Estimated for months 19-39	7.50	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	10.75
Actual for months 19-39	8	0.5	0.75	0.25	0.46	0.35	0.28	0.25	0.27	0.87	0.5	0.2	0.20	0.25	13.13

h t t p : / / E n g a g i n g S c i e n c e . e u

Appendix: External Evaluator's Report

engage

Equipping the Next Generation for Active Engagement in Science

7
SEVENTH FRAMEWORK
PROGRAMME

External Evaluation - Final Report

for DELIVERABLE Final External Evaluation Report

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EXECUTIVE SUMMARY

Engage is an ambitious and challenging project aimed at raising youth awareness of Responsible Research and Innovation (RRI) through Inquiry Based Science Education (IBSE) by changing how science is taught in secondary schools across Europe. It aims to shift the teaching of science away from a focus on established facts to areas of uncertainty and debate, by transforming teachers' beliefs, knowledge and practice towards RRI teaching. The mechanisms and support for bringing about this change are complex, involving curriculum and material development, CPD, online courses, a Knowledge Hub on a website and an online community.

Engage is organisationally complex. It involves a UK based central coordinating team providing leadership and management as well as engaging in educational resource development and training delivery. There are a further ten delivery partners, nine located in European countries, and one in Israel. It is also ambitious in terms of scale. It expects about 12,000 science teachers to have used its resource materials and to have reached 2 million students aged 11-16 years

The three year project commenced in January 2014 and was due to terminate in December 2016 but was extended to March 2017. This report is the final evaluation by an external evaluator. It reports on the evaluation of the following areas: management of the project, the set up and impact of the Knowledge Hub, the impact of various teacher education interventions, and the impact on students, scientists and other stakeholders, teaching training institutions and national education policy.

Overall, the project has had good leadership and has been fairly well managed, although early and firmer steps could have been taken to address delays and to support partners who had difficulty meeting the project's objectives by the milestones.

A major achievement of the project is the Knowledge Hub located on an attractive, user friendly website. This houses an extensive range of Open Educational Resources (OERs) in English and the nine other languages of partner countries. One OER has been translated into Portuguese and another into Arabic. It has won international recognition through a prestigious award. The Knowledge Hub has around 18,000 registered members, but well over half are from UK. There have been approximately 130,000 downloads, and although all the partner countries have had their resource materials downloaded, the majority are downloaded from the English language webpage. Teachers from 85 countries have accessed the website demonstrating the wide reach of the project. There has been a high degree of exploitation of the OERs which have been widely disseminated though digital and print channels, and the profile of the project has been raised through conference presentations and publications. While there is no robust evidence collected by the project to confirm that the target of 11,750 teachers using the materials has been reached, a guesstimate based on the number of registered users and downloads suggests that the target may well have been met. The website will be maintained until 2020 and there is a strong likelihood that the web traffic will continue to rise.

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Various professional development activities have been run for teachers such as Massive Online Open Courses (MOOCs), workshops and conferences. The evidence collected by the internal evaluator suggests these have been successful in helping teachers unfamiliar with inquiry based science education to positively value the approach and to acquire the skills, or be motivated to acquire the skills, to help them deliver RRI teaching to their students, initially using the OERs prepared by Engage. A further step in teacher CPD was to participate in the Transform phase which would allow teachers to transform their teaching practice by developing their own OERs in collaboration with their students, scientists, science communicators and other stakeholders. However, the Transform phase was significantly delayed. Damage limitation activities by the PD and lead for this phase helped to ensure that at least one Transform project was developed and delivered by each partner, bar one. However this meant that the ten scientists it was hoped would be recruited by each partner was not achieved and there was very limited involvement of other stakeholders.

The project expected to reach about 2 million students. Although some teachers, who downloaded resources from the Knowledge Hub, attended the MOOCs and workshops and other events used the OERs and/or the RRI techniques in their classroom, it is highly unlikely that 2 million students have been reached. The evidence suggests that students enjoyed the new approach to science education, the relevance of the topics of the OERs to their lives, and the multiple scientific skills they acquired.

The project expected at least 2 pre-service institutions and 2 in-service training providers would have integrated elements of the Engage programme in their pre/in-service provision, within each country. This target has not been met by partners, with a few notable exceptions. A major achievement of the Romania partner has been the widespread change it has initiated into teacher training provision, not only for science teachers at secondary level, but also across other disciplines and at primary levels, where Engage materials and/or RRI teaching have been incorporated.

The project planned to influence government education policy in each country by working with relevant departments and intermediaries. Unfortunately, this has not occurred in each country. A major achievement has been in the UK where Engage has been mapped on to the syllabus of a major examination board. Also noteworthy is the high level of engagement of the Romania partner with government officials at different levels of the education infrastructure which ensures they play a major role in discussions about science curricula and teacher training

Overall the project, given its complexity and highly ambitious targets, has achieved a satisfactory outcome.

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INTRODUCTION

The three year Engage project commenced in January 2014 and was due to terminate in December 2016. However, a request for a three month extension was agreed with the funders and the project terminated in March 2017.

Engage is an ambitious project aimed at raising youth awareness of Responsible Research and Innovation (RRI) through Inquiry Based Science Education (IBSE) by changing how science is taught in secondary schools across Europe. Science teachers typically focus on delivering the canon of scientific knowledge to their students. RRI-based teaching by contrast focuses on how we know what we know i.e. the nature of science and the effects of that knowledge i.e. its social impact. Such an approach requires the adoption of different pedagogies such as inquiry which is fundamental to the Engage project.

Engage is a hugely challenging project. It links available knowledge outside the classroom such as science media that has an impact on citizens' lives to create controversial socio-scientific dilemmas, which hook learners' curiosity and 'need to know' in the school. Students think, talk and develop informed-based views using science connected to their life, interacting also with scientists. Through contemporary Open Education Resources (OER) and guidelines, teachers support them with ten inquiry skills for RRI, which are grouped in four areas: enquire, analyse, solve and communicate.

As Engage aims to shift the teaching of science away from a focus on established facts to areas of uncertainty and debate, it needs to transform teachers' beliefs, knowledge and practice towards RRI teaching. This is underpinned by a 3-step model whereby teachers Adopt, Adapt and Transform their pedagogy in order to positively impact students' skills, attitudes and behaviours in science. The mechanisms and support for bringing about this change is complex, involving curriculum and material development, CPD, online courses, a website and an online community.

Engage is organisationally complex. It involves a UK based central coordinating team providing leadership and management and engaging in curriculum development and delivery. In addition there are a further ten delivery partners, nine located in European countries, and one in Israel. It is also ambitious in terms of scale. It expects about 12,000 science teachers to have used its curriculum materials and to have reached 2 million students aged 11-16.

As a result of Engage, it is expected that students will be able to not only acquire scientific knowledge but also be able to:

- analyse, evaluate, reason and argue (skills)
- feel able to reach an informed viewpoint (attitudes)
- watch or discuss science issues (behaviours)

More science teachers using the three stage model will:
- use RRI pedagogy with Engage materials (Adopt)

- start to change beliefs, knowledge, practice (Adapt)
- make substantial move to RRI teaching (Transform)

The project has had two external evaluators. The first evaluator provided an annual report at the end of 2014, and a mid-year report in October 2015. In October 2015, I was appointed as the new external evaluator of the Engage project to replace the Centre of Education and Inclusion Research (CEIR) at Sheffield Hallam University as internal restructuring meant that the independence of the evaluation could not be maintained. I provided a report for internal use only to the consortium in September 2016, recommending areas of project management and project activities that could be improved to help ensure the aims of the project were reached by the end date. Several recommendations were taken up.

This report is divided into eight parts. It begins in Part 1 with section 1 outlining the aims of the final external evaluation and section 2, the methods and sources of data used in the evaluation. Part 2 of this report evaluates the management of the project. Section 1 examines the quality of the project's leadership, section 2 its co-ordination and section 3 the nature of partnership working. One of the objectives of the Engage project is that about 11,750 teachers will have used its science education resources. The Knowledge Hub (KH) is the main repository for the Open Educational Resources (OERs) produced by the project is a major and significant output of the Engage project. Part 3 evaluates the KH, with section 1 looking at the set up of the KH, section 2 the quality of its content, section 3 its use by teachers in partner countries, section 4 its use by teachers worldwide, and finally in section 5, an exploration of its legacy.

The impact of Engage on teachers through professional development activities is explored next in Part 4 which comprises four sections. Section1 explores the benefit to teachers of participating in MOOCs, F2F workshops and other events. In the Engage project, the Transform phase provided a key way of embedding RRI teaching by giving teachers a deeper experiential learning opportunity to develop and deliver their own educational resources and lessons in collaboration with students, scientists and other stakeholders. The challenges and impact of the Transform phase is evaluated in section 2. The Engage project expected to set up a community of teachers and section 3 evaluates the extent to which this has been achieved. The recipients of Engage materials and RRI teaching are students and the impact on them is explored in Part 5.

Since RRI teaching involves scientists and other stakeholders in the development and delivery of science education, the impact of the project on them is examined in Part 6. The Engage project aimed to get its materials and RRI teaching included in pre and in-service teacher training institutions and the extent to which this has been achieved is examined in Part 7. Finally in Part 8, the impact on national policy in partner countries is examined. This report finishes with a Conclusion.

PART 1: EXTERNAL EVALUATION

Section 1: Aims of the Final External Evaluation

As an extensive internal evaluation of the project has been undertaken continuously throughout the project, this final external evaluation is designed to be 'light touch'. The project has various numerical targets but while this report takes cognisance of them, it adopts a wider perspective which takes account of qualitative data to assess direction of travel towards stated aims. As noted in the mid-year review report, the final external evaluation report aims to specifically focus on the following questions:

- ➢ How effective was the management and partnership working?
- ➢ How well have the partners worked individually and with each other?
- ➢ What has been the impact of the project on:

  - o Teachers
  - o Students
  - o Scientists
  - o Pre and in-service teacher education
  - o National policy makers
  - o Other stakeholders

- ➢ What will be the lasting legacy of the project?

Section 2: Methods and Sources of Evidence

The final evaluation of the Engage project has since October 2015 used the following methods and sources of evidence:

- Attendance at about 12 weekly partner online video meetings to keep abreast with project developments, challenges and approaches to address them
- Attendance at partner meetings in Romania (June 2016) and UK (February 2017) to gain an understanding of the project overall, progress and issues and to obtain informal feedback from partners. (Unfortunately, attendance at the partner meeting in Israel was not authorised by the management team)
- Formal F2F interviews with 5 partners at partner meetings in both Romania and UK
- 12 one-to-one meetings (F2F and telephone) with the PD and Project Co-Coordinator and several email exchanges
- F2F/telephone interviews with key informants in Romania and UK
- Attendance at a CPD event in UK presented by the PD
- A focus group with a class of secondary school students in Romania
- A brief partner survey in February 2017 focussing on communication, leadership, management and partnership working

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- Critical review of the final reports on all work packages with follow up emails and telephone conversations with work package leaders to clarify points and obtain further details where necessary.
- Critical review of the statistics relating to the Knowledge Hub on the Engagescience.eu portal including detailed discussions with the website team
- Critical review of various findings emerging from the continuous internal evaluation activities
- Survey of a small sample of scientists involved in Transform projects in partner countries
- Survey of a small sample of teachers who attended the RRI festival in UK
- Roundtable discussion with partners of external evaluation findings

PART 2: MANAGEMENT OF THE PROJECT

The impact of a project, and hence its legacy, is dependent on its management. Section 1 examines the quality of the project's leadership, section 2 its co-ordination and section 3 the nature of partnership working.

The Engage project is made up of 14 partners, 11 of which are delivery partners. As directors and overall lead for the Engage project, Sheffield Hallam University (SHU) had responsibility for the leadership and management of the programme. This has included providing the intellectual framework for the project, coordinating the activities of partners and monitoring progress so that project objectives are met. This has involved conducting weekly team meetings and regular face-to-face (F2F) meetings of all partners in different locations; task management on ASANA; appointing project advisors and the new external evaluator and leading Steering Board reviews.

I distributed a questionnaire to partners in February 2017 probing aspects of project management and partnership working. Respondents were asked to provide a score on a scale of 1(low) to10 (high).   In order to encourage honest responses, I said the information would be treated as confidential. Hence, the quotes cited below are provided anonymously with no attribution to partners provided.

Section 1: Leadership of the Project

The majority of partners felt that good leadership was provided by the Project Director (PD) (median score 9) as evident from the following comments:

> *Always efficient, always right with the time schedule, very reassuring and comprehensive, easy to understand because very clear.*

> *Effective with a clear idea of what needed to be done*

> *Tony was always well organized and has the skill to organize the rest of the group as well in terms of delivering everything on time. Furthermore, he is also amazing in organizing the discussions and putting everything into perspective. This was especially evident in all Flash meetings in which Tony was present.*

> *The PD has made visible efforts to keep the project on the right direction. He didn't communicate very well with the partners at the beginning of the project, but in time he improved his communication style*

As would be expected, the PD had a great deal of academic and practical experience in the field of science education. His intellectual approach was very well articulated in the DOW. However, to facilitate the practical implementation of this approach, it was very important that all partners had a shared understanding. This was particularly important because the level of expertise and experience in the field of science education and training of teachers varied a great deal between partners. According to one partner:

> *Project progress was probably delayed in many cases partly because pedagogical concepts and ideas were not sufficiently developed at the start (in particular which "pedagogical tools" should be included in videos, workshops, MOOC etc). Less time could probably have been spent on analysing RRI in national curricula, which was not particularly useful.*

A shared understanding of RRI was eventually developed and a clear definition was provided on the website mid-way through the project.

A couple of partners felt that there could have been better monitoring of project progress and early intervention to prevent delays. Two partners gave a low score (6, 7):

> *The project is delayed; the director could have seen this before and taken necessary actions for this. Some countries are behind their targets from the beginning of the project (e.g. Germany) there was no action for this. This country is finishing the project with almost no impact.*

> *Tony had a strong vision of the direction where the project should aim. He is scientifically respected by everyone. However, he was not always able to facilitate the expression of other partner's visions, and other partners experience and field of competences were underexploited. .... This plus his multiple absences created a lack of understanding and difficulties. Also, personal links between the coordinator and one partner increase difficulties in role attributions.*

> *The collective decision making process was frequently overrun by an authoritarian decision of Tony. That ended up with partners being put in a very passive position for the duration of the project, and a sort of disengagement from the project.*

It is inevitable that not all partners would be in total agreement about how the leadership role was executed. In any complex project involving a central management team and several partners, a balance has to be struck between giving partners autonomy and exercising central control. This dynamic is exacerbated with the geographical dispersal of partners, the new institutions and new colleagues that the central team has to work with. Indeed, the role could be enacted in different ways at different stages of the project as new challenges and issues arise, as they inevitably must.

A few months in as the external evaluator, my assessment of project management was that, far from the PD being authoritarian, he needed to exercise more authority and central control. After attending the partners meeting in Romania (June 2016) it

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was evident to me that a large part of the uneven progress among partners was due to two factors. First, while there were generic challenges that all partners faced in project implementation, each partner faced specific challenges due to a different set of constraints in each country because of the education infrastructure. Second, not all partners were equally capable and confident in articulating their difficulties and finding solutions to address them. In addition, I felt that there were intellectual and ideological differences between the PD and the lead for the Transform work package which was slowing down the implementation of the Transform phase.

While the various multilateral meetings were useful, nevertheless, my assessment was that there was insufficient time to address the needs of each partner. I recommended that the PD have one to one meetings with each partner. Drawing on his vast experience of science curriculum development and initial and continuous professional development of teachers, my assessment was that he would be able to explore constructively and creatively with each partner how they could better meet the objectives of the project.   The PD took up this recommendation and at least one meeting was held with each partner. All partners thought these were very effective (median score of 9) except one (score 5).

> *Tony was systematic and very much focused on achieving project targets and goals.*

> *Very effective. We had a very productive talk*

> *It was very helpful for me to speak with Tony in order to prepare the final event. It was great that Tony could come to xx to give a conference in the context of the annual meeting of the society for subject didactics*

> *We were able during those meetings to discuss issues that were specific for our group and find solutions. It was more efficient than a Flash meeting.*

In one case, the meeting provided validation of plans.

> *We had a very good plan of what we need to do. We presented the plan to Tony and he approved.*

The partner who gave a low score of 5 was not discontented with the 1:1 meeting but being very confident about its work, did not feel the same need for additional support as other partners did

> *We just did one of these meetings. Most questions were clear for us as we have a high level of attendance to Flash meetings.*

The PD also felt that the meetings had been very useful and that partners felt supported in the action they needed to take. He felt that there was a greater chance that the pace of progress in the Transform phase would increase. Although he recognised that there was still a risk that targets for the Transform phase might not be met by all partners, nevertheless, he felt reassured that there would be significant progress.

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When asked in the questionnaire whether it would have been useful to have 1:1 sessions in the first two years of the project, the majority of partners thought it would have been helpful but a couple were unsure.

> *The 1 to 1 sessions are great to define individual/national strategy. One of the strengths of the project was its implementation at European scale in 9 different languages. However all countries had different context and should have applied different strategies. So Yes 1 to 1 sessions were needed in the first 2 years, especially when changes were made or delay happened. These 1 to 1 could have take into account the diversity of partners and the different challenges that they have faced. However, these meetings would have truly been useful if their results were then merged in a global sharing and the building of a common vision for the project: even more than the 1 to 1 meeting, this is what lacked in the project.*

I endorse this view. At the beginning of the project, the Engage project produced a report which identified the challenges that each partner was likely to experience given the specific education infrastructure in their country. My assessment is that it was incumbent on the PD to provide more support to those countries facing greater challenges, through possibly him solely holding 1:1 meetings with them or holding meetings in conjunction with the partners responsible for the specific work packages for the Adopt, Adapt and Transform phase,   This is likely to have resulted in a substantial increase in the number of teachers involved in Engage, particularly in partner countries with very low or low engagement.

While the majority of partners felt that 1:1 meetings would have been useful early on in the project rather than only in the last nine months, one partner thought that

> *I am not sure that one to one sessions during the first two years would have been useful given that the nature of the work that needed to be done during the first two years was different, and more straightforward (e.g. workshops, Mooc, dissemination of ADOPT activities).*

The Transform phase represented the most challenging phase for all partners, as they had to work directly with experienced teachers to prepare their own Transform projects and many partners did not have the high level of curriculum design and interdisciplinary experience and skills necessary and, therefore, PD support was very helpful. Nevertheless, my assessment is that all partners and some more than others, would have benefited from more direct dialogue with the PD during the early part of the project.

Section 2: Project Co-ordination

The project coordinator was responsible for day-to-day project management. As noted earlier, the previous project co-ordinator had retired and there was a replacement. The new project co-ordinator had experience of both project management and curriculum development. Nevertheless, he found coming into a project halfway through its implementation posed a steep learning curve. Partners' scores were evenly spread between 7-10 on the scale.

> *After .. retirement, Andy was put in the situation to solve some important problems of the project (with financial impact) and he did everything great. Also, the communication with the partners was very good.*

Andy was a good match to Tony. He has the great ability to underline positivity in every situation and that was really needed in some critical moments. My only concern was the financial monitoring. No regular expenses monitoring was not really done and that could be a issue at the end of the project

His contribution in general to thinking of and promoting the project was very valuable

Very pleasant and helpful project manager

A partner who gave the lower score of 7 said:

It was good, very supportive, however some problems were not solved in terms of partners' delays and lack of reminders to ensure project completion. Another issue was the problem with EC that could be avoided, which provoked delays.

Section 3: Partnership Working

The success of the project is dependent not only on the leadership and management provided by the central coordinating team, but also on how well the partners worked together and the mechanisms provided for facilitating this.

Online meetings (using FLASH) were held every week (apart from holidays) and partners found them highly effective (median score 8 on a scale of 1(low) and 10 (high). Not all partners turned up each week but there were usually good reasons for this, such as an unavoidable teaching commitment. The management of the meetings had improved, with partners required to give regular, brief updates on overall progress, as well as addressing substantive agenda items. Those who were unable to attend could catch up by listening to the recordings.

They were really helpful to hear new information and to get explanation to any question (LEI, Lithuania)

Very helpful. Could reach (score of) 10 if all partners attend, but of course, it is not possible having always all partners available. (ELS, Italy)

Tasks were allocated to partners before and after the meeting by the central team and work package leaders using an online platform, ASANA. While for the external evaluator's mid-year review, partners reported mixed experiences with ASANA, responses to my February 2017 survey found that the overwhelming majority of partners found ASANA very effective. With the support of the management team, the early problems experienced by some partners were ironed out, although the way some partners used it could pose some problems

The ASANA platform improved some functionalities during the last year of the project and was more effective for communication than before. (FORTH, Greece)

Asana is a very useful tool, but when are created many subtasks allocated to the same people, it becomes very difficult to follow. (VUT, Romania)

In addition to weekly meetings, there were also several F2F meetings. These were hosted by different partners in their own countries. These meetings were designed to provide opportunities for partners to meet F2F and discuss substantive topics and the opportunities and challenges they raised. This report covers the three meetings

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in Israel (not attended by the external evaluator), Romania and Sheffield. All were considered well organised and highly effective, with the Israel and Romania meetings scoring slightly more highly than the Sheffield one.

The discussions and seminars were reported as being fundamental to deepening the relationship between partners, resolving difficult issues and planning future activities.

> *Useful and helpful in organising the remainder of the work (Israel and Romania) and helped to get better coordinated in sustaining and expanding the legacy of the project (Sheffield) (FAU, Germany)*

> *Very well structured particularly the extra activities for developing collaborations among partners. (OU, UK)*

Referring to the Sheffield meeting:

> *I acknowledge the coordinator group for their way to close smoothly the project, in an agreeable way. (DICS Switzerland)*

> *Helped to get better coordinated in sustaining and expanding the legacy of the project (Sheffield) (FAU, Germany)*

However, one of the limitations of the partnership meetings was that no notes were kept of the meetings. Hence, discussions were not captured which meant there was no shared understanding/ agreements that could be communicated universally to other team members unable to attend. It also meant that agreed actions were not always followed up. This point had also been made in the mid-term external evaluation with reference to three previous meetings and, unfortunately, it was not addressed in the three subsequent meetings covered by this report.

Partners generally valued working with each other.

> *The overall outcomes in terms of management coordination and collaboration among partners were satisfactory and interactions were very pleasant interactive and productive*

> *The consortium worked really well during the lifetime of the project, and my hypotheses is that these is due to: (a) the very well organized work plan that was provided by Tony and his group, and (b) the variation of people in the consortium (e.g. not only researchers with high profiles but also young researchers and practitioners). So one important lesson is that a diverse group of people in terms of previous experience is helpful.*

> *Most partners showed a cooperative attitude, by being responsive, reachable, and delivering good quality work. Collaboration with them has been fruitful.*

> *A small number of partners have shown less availability in the project, probably due to the fact that they played a smaller role in it.*

As would be expected, the nature of the relationship between individual partners varied. Better alliances were formed between some partners, and with some individuals within the partnership, than with others.

> *Most of the time I felt that each country is performing independently. . However collaboration took place in many various ways, especially via the meetings, emails and flash meetings. I loved it that I*

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was invited to Genoa to contribute to thinking relating to the platform, I worked very well with x (five individuals from 5 partners)

All partners have a great area of expertise and are really resourceful. However, these qualities were not used as they could have been in the project.

The diversity of the consortium was both strength and a weakness. The strength lay in the opportunities for creativity, innovation and mobilising of expertise. Its weakness lay in the fact that not each partner was on the same page at the same time. While part of this was due to the specific challenges raised by different education infrastructures in each country and different approaches to pedagogy, it was also a reflection that not all institutions had the same level of access to teachers, teacher associations and a range of stakeholders. Furthermore, not all had experience of working directly with teachers. This suggests that greater care should have been taken in the selection of institutions prior to submitting a proposal for the project, a view shared by the PD. However, the demands of submitting a detailed proposal in a very short space of time prevented a greater level of due diligence being carried out.

The experience of working in the Engage project provided partners with some valuable lessons which they plan to take to future projects.

> *Engage is a great project well thought and with good elements of delivery. We have learnt a lot as an institution and individually. We have implemented good practices while working with teachers at Traces which are now part of our daily practices.*
>
> *What was really good were flash meetings; similar platforms could be used in future projects. Secondly, hosting and management of multilingual website of the project was really successful*
>
> *For the future project, it is necessary to plan the 1st year as the preparation year. This is what we missed in the Engage. More time for the discussion in needed. We did not have any time to discuss what RRI is, what RRI is science education is, etc. In the mid-term review partners still did not have shared understanding about RRI. More time for discussing the approach, pedagogy and our strategy is needed.*
>
> *The coordinator should be aware of the strength and weakness of each partner and take this into consideration during the project life. It is important to have a complete overview of who is doing what. This was also missing in the first half of the project.*

As collaboration between institutions is a prominent model, one of the lasting legacies of the project is the valuable experience which partners will take to positively influence future projects they will be involved in, both in science education and other topics.

Good leadership, management and partnership working helps to meet the objectives of the project. In the remainder of this report, the extent to which objectives have been met and impact achieved are assessed.

PART 3: THE KNOWLEDGE HUB

One of the objectives of the Engage project is that about 11,750 teachers will have used its science education resources. The Knowledge Hub is the main repository of

its education resources and is a major and significant output of the Engage project. Section 1 below looks at the set up of the KH, section 2 examines its content, section 3 its use by teachers in partner countries, section 4 its use by countries worldwide, and finally in section 5 the legacy of the KH is evaluated.

Section 1: Set up of the Knowledge Hub

The Lattanzio group (ELS, Italy) provided the KH, namely the technical platform supporting the project's main activities. The work focussed on the development of the project website, the materials platform and online community. It also included the development of the virtual environment for the online courses and the learning analytic tools to record the use of materials and online community interactions. Complementing the work undertaken by the Lattanzio group was VUT (Romania) and the OU were also involved in the development of the EdX platform and analysis of technical aspects in order to assure a secure and trusted on-line environment for the KH.

It is commendable that the Lattanzio group paid considerable attention to designing the website and continuous improvements have been made to it throughout the project to increase its functionality and user friendliness.   As they pointed out:

> *From our side, we tried to be as supportive as possible. When partners asked for technical assistance, we provided user guides and video tutorials, showing the procedures step by step and offering to assist live in Skype via screen sharing. (ELS Italy)*

The KH has been enriched by new technical functionalities which have promoted more user-generated content as follows: (a) the rating system allows new users to identify appropriate materials more easily (b) teacher ability to respond to other comments has facilitated the development of reflective conversations (c) the personalization function reminds users to make comments on the last downloaded materials and the comments made by an expert teacher can be highlighted by adding the 'Expert' tag and (d) the brokering system contains the list of all experts, presents the expert profile and provides a way to establish contact between users and a specific expert. Partners could monitor progress and acquire analytical data on a regular basis which enabled them to make changes to improve accessibility to materials and promote better interaction with users.

Despite the availability of the improved functionality, the full potential has not yet been realised by partners and users. Partners have only minimally taken advantage of the brokering system to provide details of scientists and other experts, although this varies among partners. This is mainly because the Transform phase has not been implemented as early and fully as envisaged and, consequently, the large cadre of scientists, media, industry and other experts has not been recruited. The project has reported that cumulatively there are 3,500 comments but this represents about a fifth of users - a relatively small proportion of users. It is difficult to ascertain the extent to which the users who leave comments are representative of all users. The opportunity for reflective chats between teachers has only minimally been taken up by teachers and, hence, there is minimal evidence of a substantial online community of actively interacting teachers.

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Section 2: Content on the Knowledge Hub

The KH contains an impressive range of 30 Open Education Resources (OER) incorporating about 62 lessons. Three types of OER (Topicals, Sequences and Projects) have been posted. These have been developed by SHU and cover a diverse array of topics based on contemporary science: Earth, Ecosystem, Electromagnetism, Energy, Forces, Genes, Matter, Organisms, Reactions and Waves. As well as covering the key science subjects of physics, chemistry and biology, it is noteworthy that in the OERs good links have been made with other disciplines. They cover materials developed during the Adopt, Adapt and Transform phases and, therefore, encapsulate different content, pedagogic skills and exercises to foster mastery of the ten scientific enquiry skills. A set of templates for pedagogical techniques and concept explanations and guides for facilitators have been produced. The facilitator notes guide the teachers through the lessons. All the resources have been translated into ten languages, with some localisation taking place. In addition, each web page has information specific to the partner country such as dates for forthcoming events and reports on events and activities that have already taken place.

The high quality of the Open Educational Resources available on the KH has been recognised by a prestigious award. Engage has won the 2017 OER & Project Award for Open Education Excellence, which was announced by the global network of Open Education in February 2017. The award was presented at the global conference of the Open Education Consortium in Cape Town, South Africa in early March 2017. The award was made in recognition of the innovative approach to Open Science Education which promotes RRI.

Section 3: Use of the Knowledge Hub by Teachers in Partner Countries

Teachers can access the Knowledge Hub in ten languages, including English. The project has undertaken an analysis of the web traffic and reports the following statistics:

- 154,186 visitors
- 18,043 members
- 126,674 downloads
- 674,638 page views
- 2,500 new visitors
- 85 countries users

I have undertaken further analysis which shows that the picture is very varied across the partners. While there is undoubtedly activity in each partner country, nevertheless, the scale has been considerably less than in the UK (see table 1 in the appendix). As English is an international language, some of the members of the English page come from a range of countries. However, around 50% of all members are from UK.   Members from some partners (Spain, France, and Switzerland) constitute on average 9% each of all users, while for other partners such as Germany, Greece and Cyprus there are 2% each of members.

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The project reports around 130,000 downloads. While these figures are impressive they mask a number of issues as follows:

(a) not all members have downloaded materials. The statistics show that while some registered members of the website downloaded materials, a large number did not. Of those who have downloaded materials, there is considerable variation with some having one or two downloads and others having 20+ downloads. One user had 222 downloads and closer analysis revealed that he had downloaded several copies within a single OER of one resource e.g. five copies of the Ebola Teachers guide, 50 copies of Life on Enceladus?; 12 copies of Eat Insects.

(b) The amount of downloads varies per partner and also per OER. This is partly a reflection of how well the KH and individual OER is promoted by each partner, and also whether the topics can be included in a timely fashion within the existing curriculum in each country. For instance, some countries like Cyprus and Romania specify very strictly what topics will be taught and when in the science curriculum and how much time the teacher is expected to devote to the topic.

(c) The quantitative data on how the materials have been used is weak. The project reports that there were 3,500 comments and votes. This figure represents about 3% of the downloads. Unfortunately no analysis has been provided by the project which shows the total number of comments and votes per partner and per OER. Notwithstanding this, a review of the website shows that the number of comments per OER is not equivalent to the number of downloads. It is likely that many teachers who use the materials do not wish or have time to leave comments. Relying on the number of comments on the website as an indicator of use of resources is not a robust indicator of use.

The internal evaluator conducted a survey of users of the resources on the KH. 729 teachers responded. This is a small proportion of the users of the KH and it is not known how representative the respondents are of all users. Bearing this caveat in mind, the survey found that the Engage materials were mostly (74%) used in secondary schools. The most used materials were: 'Ban Cola', 'GM Decision', 'Big Bag Ban' and 'Electronic cigarettes'. Biology (36%), Chemistry (21%) and Physics (17%) teachers used the materials. The teachers who used the materials were more experienced teachers, having more than 6 years' experience. The teachers used the materials more with the older students (14 -16 years old). Most of the teachers (60%) found the teacher guide of the materials useful. The content of the all of the materials was regarded as interesting by the students according to their teachers. The teachers mostly liked the materials but they reported some difficulties like:

> *It required long preparation time*

> *It required prior knowledge which students do not have yet*

Most of them mentioned that they wanted to use the materials again but with some adaptation. They also reported that by using the Engage materials a range of scientific skills of the students were improved.

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The internal evaluator concluded that:

> *Overall, the Engage materials are useful and effective to reach the aims of the Engage project. Additionally, teachers' responses show that the Engage materials enriched their way of teaching science, fostered inquiry teaching, using discussions, arguing, analysing, questioning, and communicating.*

An attempt to gather data directly from users when they logged onto the website was developed in the last quarter of the project. A poll was planned of new and registered users which required them to answer 3 questions when they visited the website. Unfortunately only the UK partner conducted the poll. It did so for about five weeks from mid January 2017. Of the 321 users who responded to the poll, the overwhelming majority had used Engage resources and said it made a positive difference to their teaching. Most were happy to be contacted again and the UK partner hopes to include them in a community of practice.

The poll was a relatively simple exercise. I think the PD could have considered making the poll mandatory for all partners as it would have provided each partner with valuable information, and the data could have been aggregated across all partners to provide an overall picture. Furthermore, teachers could have been followed up and further information gained on their use of the resources in the classroom. However, the poll was only conducted in the last quarter of the project, and the sample for the UK was small. There is no way of telling whether the respondents to the poll were representative of the website users so it provides only indicative evidence. The UK partner has tried to extrapolate from this and other data and estimated that around 2,665 teachers have used the materials on the English webpage of the KH. The UK also partner estimates that about 30% of science teachers in the UK have used the materials. In Lithuania, the partner estimates that about 16% of science teachers have used the materials. Similar estimates are not available for the other partners.

Section 4: Use of the Knowledge Hub by Teachers Outside the Partner Countries

The availability of OERs in ten languages increases its accessibility to beyond the English-speaking world. Most web traffic is evident on the English language page which reflects the importance of English as an international language and medium of instruction in many countries. The users of the website come from around 85 countries including Nigeria, Indonesia, China, India and Brazil. Some of the teachers from these countries who have accessed the website are local people, while many others are foreigners with English names which suggest they may be British teachers working overseas. Some of the teachers have downloaded the materials but others have merely registered as users.

One of the intended legacies of the project is use of its resources by teachers worldwide. While the geographical reach achieved is in itself a notable achievement, greater impact could have been achieved by engaging with these foreign and local teachers to help them use the material and also to mobilise them to act as country hubs. An attempt in this direction has been made. The most commendable, and likely to have sustained impact, is the work that Engage has done with Brazil.

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This international project is the result of the laudable mobilisation of the contacts in Brazil of an Engage team member working at the Open University.

The conceptualisation of this project and its scale went way beyond anything attempted with the Engage project. The project ran for a month and used 36 Brazilian research educators as well as teachers and scientists. There were 1,473 learners including deaf people, older citizens, secondary and primary schools and members of local communities.

The project with Brazil investigated how Engage materials could be easily disseminated to promote inquiry skills for RRI in different areas of Brazil and promote collaborations between universities and schools. Participants used the Engage 'GM decisions' and 'risk' games to develop informed based opinions about genetic modified food through 'Open schooling'. This means schools working in cooperation with researchers, parents and experts, and becoming an agent for community well-being. Families were encouraged to become real collaborators by interacting through social media and events. Biotechnologists and agro biodiversity consultants working on GM and wider society were also involved in discussing real-life projects in the classroom.

The Brazilian educators found that the 'GM decisions' and the 'risk' game could be easily embedded in the Brazilian curriculum but it required proper planning. Students interacted with researchers and scientists and co-created various examples to communicate their results. The project's achievements included the creation of various products: 1 exhibition, 9 games, 4 new OERs, 42 illustrations, 1 webinar, 28 concept-maps, 1 sign-language activity for deaf people, 2 posters, 2 workshops and 4 video clips. The project concluded that inquiry skills for RRI can be fostered in many Brazilian states.

The work with Brazil has been a very good outcome for the Engage project. It is likely that many of the OERs will be translated into Brazilian Portuguese for use by teachers all over Brazil. Indeed, the OER called Exterminate has already been translated and sits on the English webpage as a webpage in Portuguese does not exist. The OER is very relevant to Brazil as it focuses on mosquitoes and many of the diseases they transmit, such as Zikka, are rife in Brazil. The teachers and other stakeholders involved in the Brazil project have the potential to form valuable and sustainable hubs supporting communities of practice.

Another small but laudable attempt to make Engage materials available to speakers of other than the ten languages on the KH is the case of Israel. The webpage of Israel, which is in Hebrew, also includes one OER, Ban Cola, translated into Arabic. This will be very valuable for Arabic speaking teachers who have attended events organised by the Israel partner but have not been able to follow up with their Arabic speaking students because they did not have resources in the language. It would be very helpful if funds could be obtained to enable all the materials to be translated into Arabic. This would be of benefit not only to the Arabic speakers in Israel and Palestine, but also for the hundreds of Arabic speaking migrants who live in the partner countries.

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Section 5: Legacy of the Knowledge Hub

The statistics on the website on the large number of registered users indicates a community of interest. Even if they do not download the materials or leave comments, a large number of teachers and science educators from the partner countries, supplemented by a few from a wide range of around 85 countries, have been exposed to the project and to RRI teaching. Some teachers who have not used the materials may, nevertheless, have used the RRI pedagogic approach and applied it where they could to their existing teaching practice. For instance, they may have involved their students through using the idea of a *dilemma*. Hence, the impact on some teachers has been of the RRI pedagogic approach, whereas for other teachers, they have not only adopted the pedagogic approach but also used the OER materials.

The Lattanzio group will support the maintenance of the website until 2020. It is anticipated that the web traffic will increase over time. Some indication of this is evident from the fact that in February 2017, 15,000 users were registered on the KH but towards the end of March 2017 this had risen to 18,000 – an increase of 3,000 in about a month. There are precedents for this pattern of increased traffic. Two examples are given here.

A project in which the Engage PD was called *science upd8* – a forerunner to Engage - had continued web traffic of about 5,000 visitors per month for 5 years and there were downloads of the materials after the development finished. The Engage project co-ordinator was involved in 2007-2010 in a project called *cre8ate maths*. According to him, the *cre8ate maths* website had approximately 2,000 users at the project end in 2010. This number increased through word of mouth to nearly 6,000 users (signed up members downloading content) by 2012m and as recently as 2015, still had 4,000 active users. Since the end of the project in 2010 no updating of the website has taken place.

It will be interesting to see if a similar trend will be manifested on the Engage KH. There are some steps being taken to stimulate the growth of users. For instance, to increase the impact on countries worldwide, the UK partner is planning to work with the British Council in UK and with their multiple local offices worldwide, to increase the publicity and use of the KH. Another step, which all partners have undertaken, has been to disseminate their individual language based resources widely to a range of online libraries and repositories. Furthermore, each partner can load the resources onto the website of their own institutions. There have also raised the profile of Engage through conference presentations and publications and many partners expect to continue with these activities. These wide dissemination activities, while noteworthy in their own right, will also draw teachers to the KH where they can make contact with other users, read and leave comments, gain ideas about how to adapt the lessons for their own students and access experts.

If the potential of the KH is realised over the next few years, then with its high quality open education resources and multiple functionalities, it is is likely to be one of the most enduring and significant achievements of the Engage project.

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PART 4: THE IMPACT OF PROFESSIONAL DEVELOPMENT ACTIOVITIES ON TEACHERS

As noted earlier, one of the objectives of the Engage project was that about 11,750 teachers will have used its science education resources. In Part 3, the role of the KH in providing access for teachers to these resources was explored. The Engage project also provided access to its OERs, and specific training in RRI teaching using these resources, through various direct training interventions.Section1 explores the benefit to teachers of participating in MOOCs, F2F workshops and other events. In the Engage CPD model, the Transform phase was intended to provide a key way of embedding RRI teaching by giving teachers deeper experiential learning opportunities. They were expected to develop and deliver their own educational resources and lessons in collaboration with students, scientists and other stakeholders. The challenges and impact of the Transform phase is evaluated in section 2. The Engage project expected to set up a community of teachers and section 3 evaluates the extent to which this has been achieved.

There have been several attempts by the internal evaluator and partners to collect data on the impact of teacher education but the caveats of small sample sizes and questionable representativeness apply. The impacts of CPD activities often require a period of time to elapse before they become manifest so conducting studies soon after training can be premature, although some longitudinal tracking has been attempted. With these caveats, the impacts of various types of CPD are explored below.

Section 1: Impact on Teachers through MOOCs, Workshops and Other Events

The OU partner was responsible for the development and piloting of the massive open online courses (MOOCs). The content covered the three areas of teacher knowledge: pedagogies, how to teach by building on students' ideas, and learning about the nature of science. The MOOCs included readings, slideshows, videos, guidelines for classroom implementation, self-assessment, and reflective assignments support. These MOOCs have been delivered by all partners. Separate MOOCs were expected to be developed and run for the Adopt and Adapt phases. However, there were multiple challenges faced in organising and running MOOCs, and there was a time delay partly because of technical problems with establishing a platform for delivery of the MOOCs. Consequently, the consortium collectively decided, after running some Adopt MOOCs, to develop and run MOOCs that combined materials and pedagogic tools from both the Adopt and Adapt phases. I think, given the circumstances, that this was a well judged approach to take.

The MOOCs were delivered mainly using the EdX platform although some partners found it easier to use other platforms. Using the EdX platform, 18 MOOCs were run with 673 registered users. Among the ones who started the MOOC there were multiple outcomes. Some of them completed the whole course, some of them performed most of the activities including online activities, some of them did only offline activities, and some of those who registered never started the course.

Completion rates varied among partners. In UK, for instance, in one of the MOOCs run in 2016, of the 107 initial registrations for the course 38 participants (36%) successfully met the completion criteria. In Greece and Lithuania, the completion rate was 50% and in Romania the completion rate was much higher at 71%. The pattern of lower completion rate compared to registration is, however, far from uncommon with any MOOCs on any subject made available by any provider.

An example from Lithuania illustrates the delivery of MOOCs. This MOOC was run for science teachers over six weeks. A guide to the course was produced, it was advertised on the university's website, and resulted in around 500 downloads. It was also advertised via the Ministry for Education and centres for non-formal education, and through professional teacher associations and agencies that provide accreditation for teachers. 102 teachers registered and started the MOOC and about half completed it and received certificates. . An online forum to support the course generated 600 messages. The course was very demanding and required a lot of time commitment which many busy teachers found difficult to meet. The partner thinks this explains why 50% did not complete all the requisite assignments to warrant a certificate

A survey by the internal evaluator of attendees of MOOCs offered by all partners, both those who completed the whole MOOCs or parts of it, resulted in 300 responses. While this is not a representative sample, at best the analysis provides some insight into teachers' views of the MOOCs. The teachers thought that overall the MOOCs had met their aims. They felt that 'video clips' and the 'dilemma presentation' were more useful than other activities including group discussions and assignments. About half the respondents reported that the benefits of the course included that they had 'expanded their understanding' of RRI, 20% reported they had 'connected with other participants' and 18% valued the opportunity to share expertise with other teachers. The MOOCs are an introduction to RRI and they have inspired teachers to take particular action after the course, with the overwhelming majority (83%) saying that they would incorporate Engage materials into their lessons. It would have been useful for the project to follow up respondents to see if they actually did so as this would have provided data on impact of the MOOC on teachers' actual practice. The majority (60%) of the teachers reported that they would recommend this course to another person which is a good testimony of its impact on them.

The project has made some attempts to sustain the legacy of the MOOCs. In order to meet the high interest in the MOOCs from teachers, but recognising the challenges involved in participation, the project has made available the materials developed for the MOOCs on the KH. This is an excellent exploitation of resources developed in one context being made available more widely. Following the end of the Engage project, in principle the MOOCs can continue to be accessed via the Engage website or other platforms used by some partners. The MOOCs can be accessed and completed by individuals without direct involvement by the partner. If this potential is realised, it will mean that many more teachers will receive training in RRI pedagogy at a pace and time that suits them.

As MOOCs are provided online, in order to provide F2F training, each partner ran one or more F2F workshops. Unlike the MOOCs which provided continuous professional development over a number of weeks with opportunities to try out the Engage OERs using the new pedagogic tools with students, the workshops provided a relatively quick introduction to the Engage project and RRI pedagogies. Some workshops provided a general introduction to Engage, while others focused on the specific phases of Adopt, Adapt and Transform. For some workshops, partners collaborated with other agencies and individuals. In Greece, for instance, the partner collaborated with teacher trainers from recognised organisations and regional science teacher advisors. Some workshops ran for two hours or less while others ran for a whole day.   Some workshops were stand alone. Others were incorporated into wider local or national events hosted by other organisations. This was a commendable strategy as all conference participants became aware of the Engage project, and some had the opportunity to learn more by attending the Engage workshops which were incorporated into the conference programme.

Given the differential nature of the purpose, content and duration of the workshops, and the low response rate to questionnaires evaluating the events, only a general picture of the impact of the workshops from the internal evaluation can be obtained. Overall the workshops increased teachers' knowledge of the Engage project, its OERs and RRI pedagogic tools. In longer workshops, teachers gained a deeper understanding of new teaching strategies, such as using contemporary and real life issues in the classroom, posing dilemmas, conducting debates and group discussions. This is illustrated by evidence from Romania where 140 teachers from several counties attended a number of Adopt workshops.   This focussed on examining how RRI techniques could be adopted in teaching science. All the teachers felt that attendance at the workshop would positively influence their teaching practices, with a fifth saying that this influence would be very substantial. Even where there were constraints in using the OERs in their teaching because the topics covered in the OERs may not align with the nationally prescribed curriculum, nevertheless, all thought they could integrate the RRI pedagogic tools within their existing teaching intermittently, and in bite sizes.

A key shift in the role of the teacher required by an inquiry based approach to science education is a shift to being a facilitator of learning. There is no robust evidence in the project to show that this has happened for a substantial number of teachers overall in the programme, and in each country. However, some indication of this shift comes from the post-evaluation survey of the MOOcs. The sample was small and the degree to which it was representative of participants is not clear, but it showed that many teachers felt their attitudes and behaviour had changed and that they had acquired skills to give them confidence to act as facilitators of learning. As would be expected, teachers who prepared and delivered Transform projects experienced the greatest change. This is evident in the case of those teachers who have been through Adopt, Adapt and Transform CPD, as for instance, have four teachers in Spain. These teachers were studied by the partner in depth which led it to conclude:

> *We can state that these are good examples of long-term and progressive inclusion of RRI in their practice by participating in our project. (UB, Spain)*

This conclusion is based on an analysis of Spanish teachers' comments on the Knowledge Hub, teachers' posts in MOOC forums, lesson preparation documents, photos and/or videos of the lessons and reflective diaries.

Further in-depth case study research with a small group of teachers from five partners looked at the teachers' pedagogical content knowledge (PCK). In order to help students to integrate science knowledge with ethical values for evidence-based thinking, teachers must develop pedagogical know-how and practice (i.e. Pedagogical Content Knowledge). One of the key findings of the study suggested that the PCK of inexperienced teachers can change by using Engage materials, without necessarily participating in long-term professional development. If this finding can be generalised, then it augurs well for the impact of Engage as teachers of different levels of experience can access one or more of its resources to initiate or improve their RRI teaching practice.

Section 2: Deeper Experiential Teacher Education through Transform Projects

The professional development of teachers through the Transform projects offered experienced teachers who were familiar with RRI principles an opportunity to participate in a deeper level of experiential learning. A proportion of teachers who had been through the Adapt and Adopt phases of training were expected to progress to the Transform phase. This has been the case, as illustrated by Greece, where 10 of the 40 primary and secondary pre-service and in-service teachers who completed the Adopt and Adapt phases, progressed to the Transform phase. Unlike in the previous phases of CPD where teachers used or adapted existing OERs, in the Transform phase, they would be in the driving seat developing curriculum materials with input from their own students, scientists and other stakeholders. They would embed their lessons with a range of pedagogic tools to help their students gain deeper mastery of key scientific skills.

The Transform phase was the final phase and one of the most challenging parts of the project. It had been allocated 43 person months. Work on this phase was due to start in month 16 of the project. It was led by Traces, France. This phase was well planned. Traces disseminated their proposals at partner meetings as early as 2014 and re-presented the approach and discussed it with colleagues at subsequent partner meetings in Cyprus, Israel and Romania. Guidelines were produced by Traces to help partners identify scientists and other stakeholders. Each partner undertook this exercise and each identified organisation, networks and individuals that they could draw on.

However, the implementation of the Transform phase was delayed by several months. Traces says this was mainly the result of a cascade effect of a delay in the implementation of earlier phases (Adopt and Adapt) which were conceptualised in the Theory of Change by the PD as being precursors to this phase. This model, however, failed to recognise that some experienced teachers did not have to go through the earlier phases, particularly those who had been involved in previous RRI programmes. Traces felt that these teachers could have commenced with the Transform phase much earlier on in the programme. While this might not have been possible in each partner country, it was a strong possibility in at least some countries

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which had been involved in other EC science education programmes like *Irresistible.* A failure to reassess the assumptions underlying the Theory of Change early on, and at regular intervals in the implementation of the programme, may have contributed to a failure to consider the merits of running the Transform phase in parallel with the other phases in some countries.

SHU as lead for materials development prepared two global Transform projects (Exterminate and Ecophone). A draft of these materials was shared with partners in March 2016 but they were not finalised until June/July 2016. These served as exemplars of Transform materials. The summer break meant that dedicated work on developing materials by partners did not commence until September 2016.
In a meeting with the PD in July 2017, I recommended that the Traces team provide 1:1 sessions for each partner. Following his 1:1 meeting with Traces, where differences in intellectual approaches to teacher education were resolved and a positive way forward was agreed, a more effective collaboration between Traces and the PD ensued through meetings and email exchanges.

> *Tony also relayed to Traces information collected during the 1 to 1 (with partners). That was a great help to the strategy of support that we put in action in the Transform phase. (Traces, France)*

At the recommendation of the PD, the Traces team provided 1:1 support to partners, helping them to take account of the local education infrastructure, to take advantage of opportunities and address any barriers. Another challenge of the Transform phase was that many partners had little or no experience of the open schooling approach. As a result, without specific 1:1 support from Traces, it would have been less easy for many partners to progress at the pace required by the project, and in particular, the accelerated pace required as a result of the late start to the implementation of this phase. The Traces team thought that the 1:1 support was very productive. In their final reflection on their task, Traces who are very experienced in open schooling, noted that stronger efforts should have been made earlier on in the Engage project to provide support to partners to help them learn how to use an open schooling approach.

Analysis of responses to my February 2017 questionnaire reveal that the 1:1 support was appreciated by all the partners who found them very effective (median score of 9) as evident from the following comments:

> *Helped ILI to overcome/address some of the difficulties encountered with the Transform phase (FAU, Germany)*
>
> *It has been effective for the WP leader for monitoring processes & also to the partners for discussing and solving probable issues on Transform implementation in their countries. (FORTH, Greece)*
>
> *Partners presented their own plans for the Transform phase and had an opportunity to clarify some problematic questions regarding the organization of RRI festival and Transform MOOC (LIE, Lithuania)*
>
> *It was particularly helpful because this phase needed further concretion than what was stated in the DoW, especially considering the limited time to complete it. (UB, Spain)*

The two global Transform curriculum materials (Exterminate and Ecophone) were put on the KH at the beginning of October 2016. Each partner then translated and localised the materials and placed them on their webpages.   These materials were available for use by teachers from October 2016.   Each partner had a target for downloads and the anticipated total number of downloads for both the global and local projects was 365. However, by March 2017, the number of downloads for the global projects far exceeded this, amounting to 2,465 for Exterminate and 2,444 for Ecophone. Hence, all partner countries (bar one) exceeded their targets by a very wide margin. However, Germany did not, and the number of downloads for the global projects was only 25 which represented only 31% of its projected target.

While downloads do not equal use, nevertheless the high level of downloads indicates the interest there is in these materials. Some teachers who have used them have posted extremely favourable comments. A teacher from Spain, for instance, highlighted both the relevance of the topic (Exterminate) to her students but also how the material would need to be adapted to make it directly applicable to their situation:

> *During this academic year, a group of teachers of biology, physics-chemistry and technology in my school want to devote some sessions of the course to carry out a project with an adapted group from 3ºESO. The objective is to learn by competences by carrying out a project on the topic of mosquitoes. This resource seems interesting in our case because it is an issue that may interest students, because in our school we get quite many mosquitoes. It would be an issue that affects them and in which to work to find solutions. The proposed contents would have to be adapted to the level of the classroom and would take a more applied point of view to analyze how to solve the problem of the school. The greatest challenge will be the multidisciplinarity of the project, as it will involve coordination among the three teachers. (teacher, Spain)*

All the partners were expected to produce their own local Transform projects. A local project was defined as:

> *Teacher led projects involving scientists/media/museums... (that is, they involve direct contacts with real life situations/actors).*

All partners, apart from Germany, produced completely new curriculum materials, one each, covering a broad range of topics. All partners were going to use local experienced teachers to develop local Transform projects. However, as Germany was unable to recruit local teachers for this task, Traces had suggested that the German partner produced a project itself. However, this did not materialise. The German partner gained permission from another partner, Greece, to use its local Transform project. Its plans to translate this into German were stalled when the translator went sick. This is a case where the PD and Traces could have taken more steps to help address problems that Germany was facing in developing its own Transform project. Germany has reported that it has a number of events hosted by other organisation in April 2017 where it can present its borrowed Transform project.

Ten local Transform projects were prepared by partners involving teachers, students and scientists in their development and delivery. The quality of these local Transform

projects appears variable which could have a negative impact on the high quality of teacher education that the Engage project has tried to maintain. Furthermore, as these local Transform projects will appear on the KH which has been publicly commended for the quality of its OERs, it is regrettable that the PD/Traces had not arranged for these materials to be quality assured.   This would have ensured that they were of the same high standard as all the other curriculum materials on the website which have been produced initially in English largely with the help of two very experienced curriculum designers. As local Transform projects are in local languages, centralised quality assurance would have been problematic. The late onset of the Transform phase meant there was insufficient time to undertake quality assurance and to improve local Transform projects where necessary.

As a result of the late development of Transform cases, each partner attempted to have at least one F2F workshop with teachers in their country to publicise the availability of the material and to demonstrate how to use it. Almost all partners were only able to run training events using Transform in December 2016 and the first quarter of 2017.   This training drew on the two global OERs and the local Transform project.

Publicity about the training was disseminated to approximately 13,500 teachers across the partner countries using devices such as campaigns, newsletters and email shots. Partners developed on-line or on-site activities to support Transform teachers. Nine partners provided MOOCs and registrations ranged from 15 to 50 in each country. Total registrations amounted to 234.   UK and Israel adopted an open model - without registration. Teachers participated in webinars and Google hangouts and digitally accessed slides, guidelines, the course book and video clips about Transform.

Further dissemination was provided via RRI festivals. All countries organised a final RRI event and the scale, format and content varied. However, all events created an opportunity for Engage trained teachers to meet, present Transform projects, and discuss open schooling and innovative pedagogies, as well as RRI topics related to science education. The internal evaluation of these festivals, based on responses to questionnaires from attendees, revealed that these were successful in raising the profile of the Engage project, stimulating interest in the KH and motivating many attendees to positively rate RRI teaching

The development of further Transform projects and their sustainability beyond the Engage programme relies on the availability of trained mentors. Mentors are experienced teachers and many have previously been involved in innovative science education projects. Each partner appears to have at least one mentor available which will contribute to the sustainability of the Engage project. However, the plans to have a large cadre of mentors in each country has not been met and this is likely to mean that, for some partners at least, local sustainability of RRI teaching may be adversely affected.

Section 3: Impact on Teachers Through a Community of Practice

As noted earlier, the Engage project has an extensive community of interest as evident by the number of users of its KH.   A community of practice with fairly regular exchanges between teachers is also necessary to sustain the project and maintain the dynamism of innovation in science education initiated by it.

The website was designed to enable online forums to be established by each partner. However, there is little evidence that this has happened because there are minimal chats via the forums. However, online forums had been established for the MOOCs. The challenge is to sustain such communities after the end of the course or the project. The advantage of posts on the online forum is that not only does it stimulate discussion among peers but it also is a legacy for any teachers who potentially want to do a MOOC or use the OERs who can see the views of others. The vibrant forums sets up during the MOOCs are exemplified by Lithuania. 102 Lithuanian science teachers registered and started the MOOC. They also were actively involved in discussions in the forum regarding different pedagogical tools and their usage. Approximately 600 messages were written in the discussion forum.

One online community of practice that is likely to be sustained is the one set up by the UK partner after the RRI festival in London in March 2017. There were approximately 80 attendees who registered via a separately established conference website.   The PD intends to sustain this group and run a yearly event if funding can be obtained. This community of practice will help to promote the use of Engage materials among the community of teachers and through recommendations to colleagues. It will also act as a sounding board for the development of further curriculum materials and the mapping of the RRI approach developed through Engage onto the AQA science curriculum (see Part 8).

Partners have used different approaches to establish a local community of practice. A common approach has been to use existing networks, introduce Engage through these networks, and continue to foster interest by informing them and their members (in the case of membership groups) of any new events, activities and materials that have been produced by Engage. The involvement of these networks is a positive step and they are good vehicles for ensuring the legacy of the Engage project.

PART 5: IMPACT ON STUDENTS

One of the objectives of the Engage project was to have reached 2 million students aged 11 to 16 by the end of the programme. The project has not put in place any robust mechanisms for monitoring this by collecting information from users of the resources on the KH, as well as attendees of MOOCs and workshops, as to how many times they used the materials with their students, and the class size. This would have required regular and proactive contact with teachers. This would probably have been cumbersome but in the absence of hard data, my conclusion is that, while undoubtedly a large number of students have been reached, this target has not been met.

As stated in the DOW, to ascertain the 'Impacts on Students' three assessable outcomes were selected. Students:

      (i) will be more likely to discuss something related to science and technology outside the classroom (behavioural)

      (ii) will feel more confident about the process of reaching an informed viewpoint (affective)

      (iii) will critically analyse sources of evidence, weigh up the benefits and drawbacks of technology, use ethical reasoning, and argue with reasoning for their viewpoint (cognitive).

Of the students that have been reached, the project has made attempts to collect data on its impact. The information has been gained mainly from teachers' assessment of impact. Although the internal evaluator provided a questionnaire that all partners could give to teachers to use with students, this was done very late in the project and was not uniformly implemented. Furthermore, the internal evaluator had relied on collecting data from students mainly in the Transform phase but as the implementation of this phase was considerably delayed, this strategy had to be abandoned.

Consequently, information of the impact on students has to be drawn from qualitative data of studies conducted by some partners and the internal evaluator's assessment of this data. I had the opportunity to conduct one focus group with 35 students in Romania but this was done six months after they had had one Engage lesson on plastic bags so it relied on their memory. Nevertheless, it provided some insight into the value of Engage for some students.

Students were exposed to Engage in various ways: directly in the classroom, at external workshops and through individual projects. For instance in Israel, complementing the development of a comprehensive local Transform project, 10 teachers have also worked in pairs with their students to develop dilemma-based projects with the students' presentations being externally evaluated. Students had opportunities not only to use Engage materials in their classrooms but also at external events. For instance, Traces took advantage of participation in a national event hosted by another organisation to run a workshop with students using the Engage resources on Eating Insects. Students in some partner countries have also participated in student events and given presentations on their involvement in Engage.

Some insight into the impact of Engage on students can be obtained from a number of studies carried out by partners. A qualitative study of 145 students from 7 different secondary schools, aged 14 to 17 years old (in the Netherlands) whose teachers used Engage materials in the class, showed that there was a substantial increase in the students' scientific knowledge. Students felt they had also learnt a number of skills such as critical assessment of media reports and presenting arguments, They also increased in self knowledge as they realised the role they play or can play into the future which can limit adverse effects on the environment (such as level of meat

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consumption, or whether or not they use a diesel car. The finding on self knowledge can be validated by the focus group I conducted in Romania where students said, following a lesson using Engage resource on plastic bags (Big bag ban), they reduced their use of such bags and some also tried to influence their family and friends to do the same.

In Romania a study of 64 students from 6 schools, aged between 12 and 18, who were taught about unpolluted and renewable energy, found that there was an increased interest in scientific topics. Furthermore, students spontaneously engaged in critical reading and discussions on a range of topics in their leisure time. In Norway a study found that, not only secondary school students but primary school students too, regarded the Engage lessons as more interesting and stimulating than traditional science lessons. A study in Cyprus of students (14-15 years old) involved in a Transform lesson on genetics and plants which included scientists provided some evidence that students felt more confident to challenge professionals. For instance, a student planned to challenge treatment proposed for her mother by a doctor and wanted to assess whether there were other options.

A key aim of the Engage resource materials is to motivate students. All the evidence indicates that this has been successfully achieved. For instance, the Head of KS3 science in a UK secondary school responded to my questionnaire by saying:

> *Due to time constraints when teaching our old scheme, I have only used a couple of Engage OERs with our students (Two degrees and Eat Insects) but I was very impressed with how they motivated the students. The response from the students was excellent and this is why I'm planning to integrate many more of them into our new KS3 scheme.*

A teacher from Israel commented that:

> *The Engage materials approach serves to motivate the students because they see the relevance in the science they are learning.*

Students were more actively engaged in Transform projects as they contributed to their development and delivery. In Norway 10 teachers carried out Transform projects. One teacher reported:

> *The materials were highly engaging for the students and communication with insect ecologists is also working well. Thinking guides were very useful and are now successfully used by teachers in other subjects. (Teacher, Norway).*

After analysing the responses to a survey of 543 teachers across the partners and some case studies at the Adopt, Adapt and Transform phase, the internal evaluator concluded that:

> *Students had acquired or improved several skills such as critical analysis and evaluation of information and evidence from several sources (such as media, scientists, lobby groups), assessment of contradictory arguments, consideration of ethical issues, oral and written presentations of opinions and the application of knowledge to themselves and the environment by taking action. (TUD, Netherlands)*

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Although the studies of impact of Engage on students are very varied, with different sample sizes and using different research methods, they point in the general direction of Engage lessons fulfilling the outcomes mentioned earlier. Hence, although quantitative targets appear not to have been met the impact on students who have been reached have been in line with increasing knowledge, enjoyment and application of science and the acquisition, and in some cases mastery, of key scientific skills.

PART 6: IMPACT ON SCIENTISTS AND OTHER STAKEHOLDERS

In the DOW, the project noted that

> *Few (natural) scientists are acquainted with secondary education, not to mention RRI-education and socio scientific issues, and are not convinced that they 'can speak the same language' as students. On the other hand secondary school teachers often feel that they do not have the time, access or expertise to keep up with the ever increasing developments in science and technology, let alone integrate it in the already overcrowded curriculum in a meaningful way.*

The project regarded the participation of scientists in Engage as vitally important since their inclusion provides a sense of authenticity and shows that the scientific community considers the societal impact of research as valuable. As stated in the DOW, the project wanted to ensure the involvement and the commitment of a sufficiently high number (minimum of 10) of scientists per country.

The Engage project expected that mainly through participation in Transform projects, the scientific community would gain a better understanding of how to engage with teachers and students. The project stated that a measure of success would be that

Fifty per cent of scientists acting as 'RRI experts' in our projects feel more confident about interacting with teachers and students in discussion of socio-scientific issues.

Early in the second year of the Engage project, under the guidance of Traces, each partner prepared a list of institutions they would contact in order to recruit scientists, media and industry personnel, and non-formal educational institutions such as museums to participate in the Transform phase of the project. However, as a result of the late development and roll out of Transform, the plan was only minimally put into action. In the event, the partners rightly prioritised the involvement of scientists, so that at least one scientist was involved in each partner's work. This meant that the cadre of scientists that it was hoped each partner would marshal to be involved in producing and delivering a number of Transform local projects did not materialise.

Where possible, partners tried to use scientists who worked in their institution. For example, in Romania researchers from Institute of Multidisciplinary Research for Science and Technology, Valahia University of Targoviste were involved in a Transform project which focussed on smart cities based on unpolluted and renewable energy. In Cyprus, scientists from the Department of Human Biology and the Institute of Genetics and Neurology were involved. Two of the partners' researchers worked closely with the scientists and the teachers who were supported both during the design and implementation of the project. In Greece, one science and one language teacher worked with biologists and medical researchers. Other

agencies were also used by one project. For instance, in Norway the focus of the Transform project was plastic waste in Norwegian coastal areas and its impact on ocean life. The partner invited The Norwegian Coastal Administration, the Norwegian Environment Agency and an NGO, Vesar Recycling, to be involved in their Transform project.

I independently asked all scientists to evaluate their participation in the Transform projects. Unfortunately, I only received four responses in mid-March 2017. As I had to wait until the local projects were implemented with scientists, there was insufficient time to try to increase the response rate. Of the four respondents, two scientists were from Romania and one each from Lithuania and Switzerland. With such a small sample, at best, we can only obtain some insights into how they viewed their involvement in developing and delivering materials.

All these scientists appreciated being involved.   The involvement took various forms. For instance, a scientist from Lithuania said:

> I had to evaluate and review presentations prepared by teachers participating in the MOOC. The teachers prepared presentations as supplement material to the local Transform project „Firefighter 2.0". I was also invited to give a talk on the theme 'Dilemmas in our life" during the national RRI festival on the 27th of January, 2017 (Lithuania)

In Romania, the scientists helped to develop the project with the teachers, participate in the RRI festival, and involve students directly in testing gadgets to promote solar energy. All the scientists gave presentations at the local RRI festivals as they saw this as a useful vehicle to promote the public engagement in science and motivate teachers and students to involve scientists in their work.

The four scientists said they enjoyed working with the teachers and this was reciprocated by teachers. In Lithuania, the scientist said the teachers were initially hesitant but soon gained confidence to raise issues with her. All the scientists said they intended to continue working with the local partners and with teachers as they enjoyed the experience and wanted to promote the engagement of science by young people. In Lithuania the scientist intended to promote her new found knowledge and understanding of RRI

> in my future work in the preparation of pre-service teachers of technological education at LEU (the university)

The Swiss scientist intends to

> ..continue my activity with teachers and plan to try with them some of the ENGAGE designed tasks.

The success of their hand-on activities with students in arousing their scientific curiosity has encouraged the Romanian scientists to participate in a range of public engagement in science activities organised by the university for teachers, parents, students and the public.

The delay in the development of multiple local Transform projects has meant that, on average, only about two scientists have been involved in each partner country. In

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numerical terms, therefore, there has not been impact on many scientists, but of the very small number who have responded to my questionnaire, the impact has been significant. The insights make it clear that the involvement of scientists in the Engage Transform projects has encouraged them to work with teachers and students, to communicate scientific knowledge in interesting ways to students and to introduce RRI techniques and Engage resource materials into initial teacher training and CPD. If these views are held by most or all of the scientists in all the partner countries involved in Transform projects, then it augurs well for the involvement of scientists in inquiry-based science education. To ensure this potential is realised, partners, where possible, should continue to support and engage with the scientists. It is expected that the profile of these scientists will be placed on the KH so that teachers using curriculum materials in which these scientists have expertise can contact them to assist in future delivery.

Although scientists may not have participated in the development and delivery of Transform projects, there is some evidence that some have been made aware of the Engage project and advised about how they can become involved. For instance, a presentation was made to a group of scientists in UK. Scientists have also contributed to RRI festivals attended by teachers and students. For instance, in Switzerland, the scientist gave a seminar on the importance of listening and developing students' attitudes to the scientific and technical objects in the environment in order to arouse their interest to learn about them. Teachers present felt that this was a valuable contribution and felt encouraged to work with scientists.

The intention of involving the media in local Transform projects was to enable students to link school science with real world scenarios and to learn how to critically use the media. For teachers it was to link science teaching to pressing social issues and learn storytelling (in particular digital storytelling) techniques. The lack of involvement of the media in the Engage project was due to insufficient time to develop local Transform projects. There is no evidence of impact on journalists and others involved in the media and on science communicators in general.

PART 7: IMPACT ON TEACHER TRAINING INSTITUTIONS

As stated in the DOW, the project expected at least 2 pre-service institutions and 2 in-service training providers to have integrated elements of the Engage programme in their pre/in-service training, within each country.

Partners have worked with teacher training institutions to embed exposure to and use of RRI pedagogy through Engage OER and guidelines for teaching. The degree of impact has varied across partners. The evidence suggests that a number of factors account for this, but three key factors are the expertise of the partners, the institutions they are located in, and their role within these institutions. This configuration of factors was not evident with all partners.

A prime example of commendable achievement is Romania. The partner works within a university that provides teacher training. A key role its three members have played for several years is in the development and delivery of pre and in-service

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teacher training.   The Romanian partner achieved wider penetration across education levels, disciplines, and across the country than may have been expected. First, the partner was able to integrate Engage materials and RRI techniques into the curriculum at undergraduate and postgraduate levels and provide a number of sessions for pre and in-service teachers. Second, the Engage project was focussed on secondary education but the partner was able to integrate RRI pedagogy and some elements of the OERs into teacher training for teachers of pre-school and primary levels. Third, Engage focused on science education. The partner was able to include RRI pedagogy and some elements of the OERs into a range of disciplines such as Maths and other programmes in the Faculty of Orthodox Theology as well as in programmes in Geography, Food Processing, Economics, Technological Education, Education for Health, Counselling, Career Orientation, Religion and Music.

Finally, there is potential for wide geographical reach as there is a very high probability that this new approach will influence the development of teacher training across Romania. My discussions with Inspectors of Science subjects at county level, and with government officials working in national teacher training development programmes and national education policy levels, testifies to this. The partner and other colleagues at the university have a strong pre-existing relationship with policy officials and professional teacher associations. The views of the partner are respected and they were involved in frequent bilateral and multi-lateral meetings concerning teacher education. As teacher education is very tightly controlled in Romania with teachers having to undertake nationally accredited training to both obtain and maintain their teacher status, the fact that the partner has a seat at the table, both county and national, and is able to draw on its experience of delivering Engage, is an excellent achievement for the project.

While Romania has achieved the greatest impact on teacher training, some other partners too have made impact, but on a smaller scale. In Lithuania the partner's university is drawing on the experience and expertise of the work on the Engage project to collaborate with the National Association of Teachers to review the existing teacher training programme. Other partners like Spain, Israel and Cyprus have included Engage materials in university programmes. For instance, in Cyprus some of the CPD Engage materials are being used as part of the MA in Science Education training at the university. This MA is offered for in-service science teachers who are introduced to new trends in the teaching of science. Engage is presented as an example of such trends, along with the lessons that can be implemented in the class.

Some partners have collaborated with institutions involved in non-formal education. Traces, in France, which is active in the European Network of Science Centres and Museums (ECSITE) network, has collaborated with third sector organisations interested in citizenship and science and will be involved in running an event using Engage materials in May 2017.

Some partners who had only taken preliminary steps in influencing institutions providing teacher education in their country during the lifetime of the Engage project are, nevertheless, keen to maintain their momentum. For instance, the Swiss partner is collaborating with researchers and science teachers from other organisations to try

to obtain funding to continue to produce Engage resources and develop additional pedagogical tools. It intends to implement them with teachers and students in both secondary and primary schools through an action research programme. Although the Netherlands is part of the consortium, but is not a delivery partner, it has been able to integrate the Engage project into its university science education and communication Master's programme.

Overall, while there have been positive steps taken by partners to incorporate Engage in pre and in-service teacher training, the target of at least 2 pre-service institutions and 2 in-service training providers in each country has not been met.

PART 8: IMPACT ON NATIONAL POLICY AND PRACTICE

As stated in the DOW

> *Despite the fact that teachers and students taking part in ENGAGE stand to benefit most from the experience, for long-term sustainable impact we would need to alert key policymakers and practitioners of its value and the benefits for embedding successful elements in practice...... by .. publicising successful project outcomes to these policy makers we intend them to see the real benefits of RRI-teaching, in the way it provides better curriculum experiences for students and professional development for teachers".*

A key stakeholder for Engage to influence is the national government and associated agencies that help with the development and implementation of government policy. All countries in Europe have been concerned about not being able to meet the demand from the economy for scientists as comparatively fewer students are studying science subjects at tertiary level and entering professional jobs. A key way to encourage more interest in science is in schools including how the science curriculum is designed and taught. As the project notes in the DOW

> *Influencing policymakers is notoriously challenging and the appropriate mechanisms need to be flexible to adapt to changing needs and political opportunities.*

To have impact on policy makers so that there are changes in policy development and delivery, a first step is to raise their awareness of Engage and then to actively collaborate with them to make changes. Personal contacts are vital, and while all partners have been encouraged to initiate or sustain existing links with policy makers there has been very limited success, apart from a couple of notable exceptions with UK and Romania.

The UK partner has had a significant and major impact on the science education curriculum in the UK. It has ensured that the Engage framework for science teaching has been adopted by the UK national exam board, AQA. While not the only exam board in UK, the AQA is a major board. Both the mobilisation of existing contacts and serendipity played a role in making this happen. In an interview with the Head of the Science section of the AQA, she told me she knew the Engage PD from their involvement in professional associations. Following a presentation she gave at a conference, the PD talked to her about Engage.

Tony came at the right time. We were thinking about revising the Key Stage 3 syllabus. Tony's approach to Engage fitted in well with AQA's vision for KS3... So we aligned the AQA syllabus with Engage.

The new Key Stage 3 (for 14-16 year olds) Science Syllabus from AQA in the UK shifts the focus of science education from the acquisition of knowledge. Jointly developed by Engage partners, its breakthrough design reduces the science knowledge content teachers need to cover, and shows them how to put science in context by giving students the skills to apply their knowledge to real life. It is hoped that this will help make learning science an exciting experience which will inspire current and future generations of students.

The UK partner has been able to use the AQA branding on its website and to publicise and run its events. At the same time, the AQA website provides additional credibility by links on its official website to the Engage Knowledge Hub. At the RRI festival that the UK partner had in March 2017, the keynote speech was given by the Head of the AQA Science section. Experienced Engage teachers gave presentations on how they had used Engage in their classrooms to deliver the AQA syllabus. All these endorsements ensure that teachers can clearly see how the alignment between Engage and AQA works in practical terms. This has undoubtedly contributed to the high volume on web traffic on the UK webpage of the KH and to attendance at workshops and other events. Indeed there was greater demand than could be accommodated by teachers who wanted to attend the RRI festival. Those who attended clearly rated the event very highly and expected to, or had already started, taking follow up action.

Thanks for organising such an inspiring conference. I can't think of the last time I went back to school after a conference so buzzing with ideas. Are the notes from the conference going to be available on the website soon ... as I wanted to refer to some points before presenting my report to colleagues. ... I would be keen to look at all of the slides again.

I really did enjoy the conference. I took so much away from it. As a result of my presentation and further chat, I will be welcoming a delegate from another authority into school on Monday. She wants to see group work in action. There's conference impact!

The value of Engage materials to the new KS3 curriculum is well brought out by the head of KS3 Science in a large secondary school who emailed his response to my questionnaire survey of a small sample of teachers in UK.

I consider the Engage materials to be essential to our teaching and learning of science at KS3. I am currently updating our KS3 scheme and I'm integrating the Engage materials into our scheme ... to ensure that our students have a modern, relevant curriculum.

The AQA is one of three examination boards in the UK. In my internal report to the consortium in September 2016, I recommended that the UK partner should also work with the two other exam boards in England, namely EDEXCEL and OCR. This is because some schools use the syllabus from these exam boards. In this way all the examining boards would be covered and the legacy of the project would be strengthened. However, the partner has not been able to do this because of time pressures and other commitments in the project.

It is commendable however that the AQA has requested that the work undertaken for Key Stage 3 be continued to Key Stage 4 and 5. This is a very laudable way to build on the work done by Engage for the KS3 curriculum and to ensure the sustainability of the approach to further stages of the curriculum. Earlier Key stage 1 and 2 are not within the purview of the AQA exam board as they are not publicly examined but there is a strong possibility that the curricula of these earlier stages will also be influenced by the work of Engage at Key Stage 3. If this occurs, then the Engage project will have helped to ensure that there is some coherence and consistency in using of the RRI approach throughout the whole science education curriculum in England. The PD intends to use the community of practice established after the UK RRI festival as a sounding board for emerging ideas. This will be an important way to sustain the UK community of practice and ensure a lasting legacy of the Engage project. It is very likely to increase the percentage of teachers who currently use Engage (estimated by the UK partner at 30% of all science teachers).

In my internal report of September 2016, given the success with the AQA, I recommended that the PD provided bespoke support to each partner to help to make an impact at policy level.   While each partner country has different regimes and protocols, nevertheless, my assessment was that he could use his experience to facilitate the pace of progress among partners. Given time constraints, I thought it probably would not be feasible to implement this in all countries but by choosing some countries it might have been possible to have some impact. Unfortunately, there was insufficient time available to both the PD and partners to do this but partners were nevertheless inspired by the success of the UK partner. For instance, in Spain, the partner added to its webpage a posting of how Engage related to the aims of the national curriculum.

 Attempts were made by partners to invite policy officials to their RRI event. In Cyprus for instance, a senior policy official gave a presentation at the event. Cyprus has a very centralized educational system with the Ministry of Education and Culture making decisions about the curriculum and supporting resources. The policy official is responsible for policy development in science and has oversight of the curriculum design books which include worksheets, theory and lesson plans that the teachers are expected to use. During the presentation he talked about the efforts that the Ministry is making to design books and activities which place an emphasis on everyday science. In an email exchange with the speaker after the event, he told me that while his involvement in the Engage project had just begun, since the project is in line with current trends of the science curriculum

> I have no doubt that such a collaboration can be established in different levels, so that the expertise gained and the results of the project can be exploited in favour of science teaching and learning in Cyprus.

The Cyprus partner has already taken steps to capitalise on this preliminary engagement and is arranging further meetings with him and his colleagues.

In some cases, policy makers have become aware of Engage through the participation of a partner in a wider event on science education at which policy officials were present. This was the case for Switzerland. To mark the end of the

UN Decade for Sustainable Education, the Swiss National Congress invited various policy makers, including representatives from the Department of Education extracurricular partners to undertake an interim review, share experiences and develop new opportunities for collaboration. There were around 300 participants at the Congress and 18 attended an Engage workshop. The partner reported that the Congress helped to enlarge the network of science educators who became aware of Engage materials and RRI pedagogy. These educators came from a wide range of cities and, by cascading their knowledge and use of Engage materials, have helped to increase the project's visibility. The partner has not reported any follow up work with policy makers.

I had recommended that each partner prepare at least one policy brief which they could send to a policy official and potentially follow up with a F2F meeting. However, partners had insufficient time to do this. However, in my view this is also a reflection of the fact that most partners have little or no experience of using the evidence from their projects, including the Engage project, to influence national policies. This lack of experience and skills is an area for capacity building which the EC could help to address.

CONCLUSION

Engage is an ambitious project in terms of aims and targets. It has high numerical targets of 11,750 teachers using the materials, and reaching 2 million students. Large numbers of teachers needed to adopt the materials before adapting and transforming their practice. It expected to achieve this through a consortium of 14 partners, 11 of which were delivery partners, spread out across Europe and Israel. The consortium was newly formed for the project and partners came from different backgrounds and with varying levels of expertise in the field of science education. The project began in January 2014 and terminated in March 2017. Three years is very short time to conceptually frame, develop, disseminate and embed all aspects of the project and expect a measureable impact. This report is the final external evaluation of the project and covers the management of the project, the set up and impact of the Knowledge Hub, the impact of various teacher education interventions and the impact on students, scientists and other stakeholders, teaching training institutions and national education policy.

Overall, the project has had good leadership and has been fairly well managed, although early and firmer steps could have been taken to address delays, and to support partners who had difficulty meeting the project's objectives in accordance with milestones. Not all partners have pulled their weight and the project's achievements have been dependent on the work of some partners. In the case of one partner, Germany, achievements have been minimal. Early action could have been taken by the central management team to help weaker partners. It would have been helpful if an action plan had been drawn up with these partners and closely monitored.

The Knowledge Hub, which houses a vast array of OERs in ten languages, is a significant output of the project. It has justly won an international award for the high quality of its OERs. It has a good array of educational materials and pedagogic tools

to enhance mastery of a wide range of scientific skills. All the materials have been translated from English into the nine languages of partners, one OER has been translated into Portuguese and another into Arabic. It is a further credit to the project that its resources have been disseminated widely to a range of online libraries and repositories and potentially the number of teachers using Engage resources is likely to rise. A large number of teachers (18,000) are registered members and there have been about 15,000 downloads from users in 85 countries. A nascent online community of teachers is evident on the website. While there is no robust evidence collected by the project to confirm that the target of 11,750 teachers using the materials has been reached, a guesstimate based on the number of registered users and downloads suggests that the target may well have been met. The Knowledge Hub is undoubtedly one of the best legacies of the project.

Various types of teacher education activities have been undertaken in each country such as MOOCs, F2F workshops, conference presentations and Transform projects. The potential of the Transform phase has not been realised because of its late delivery. The lack of firm action earlier in the project to address delays meant that partners did not start working on developing and delivering local projects until the last five months of the project. This was insufficient time for many partners to support a number of teachers to develop high calibre educational materials with students, scientists and other stakeholders. As a result all partners, bar one, were only able to develop one local project rather than several.

Overall, there are fairly good indications that teachers who participated in the various training interventions have been positively influenced to adopt Engage materials and RRI techniques in their practice, and to have gained some awareness, and in some cases skills, to shift to the role of facilitator of learning. In the absence of robust evidence, it appears unlikely that the target of reaching 2 million students has been met. The qualitative evidence suggests that the use of Engage materials and RRI techniques have increased the motivation and interest of students in learning science and that it has helped them understand the application to their lives. On average only about two scientists have been involved in Engage and, hence, it has not been possible to meet the aim of the project to mobilise a cadre of local scientists and other stakeholders to develop and deliver innovative science education. There is some indication that those scientists who have participated valued the experience and are motivated to be involved in future preparation and delivery of science education.

It was expected that partners would get Engage materials and RRI teaching incorporated into pre and in service teacher training programmes. While there has been a notable achievement in Romania, and some lesser success in some partner countries, the aim of integrating Engage into two pre-service institutions and two in service training providers in each country has not been met.

Engage also aimed to take up the challenging task of influencing education policy makers in the partner countries. With the notable exception of UK and Romania, there has been a small amount of engagement with policy makers in some countries. Both Romania and UK have capitalised on pre-existing links to make a substantial impact on policy. The UK partner has scored a major success with being able to map

Engage onto the syllabus of a major exam board. It appears likely that this work will continue and may lead to innovative science education being embedded throughout the school primary and secondary science curriculum in England. If this occurs, it will constitute a significant lasting legacy of Engage.

As a result of the partial fulfilment of objectives of the Engage project, I conclude that the outcome of the project is satisfactory.

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