



DELIVERABLE D4.8: Annual Report on Adopters Programme Implementation

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1. EXECUTIVE SUMMARY

This document reports on the implementation of the first year of the ADOPT phase of the ENGAGE Continuous Professional Development (CPD) model. It refers to the **period July 2014 – June 2015**. The main aim of the ADOPT phase activities has been to empower teachers use RRI techniques in everyday practice with the support of materials developed – which are accessible to teachers as Open Educational Resources (OER) via the ENGAGE platform. Activities were implemented in **11 countries** of the consortium, namely: UK, Greece, Germany, France, Spain, Romania, Israel, Norway, Switzerland, Lithuania and Cyprus). In the first year of the implementation we successfully managed to: develop **20 innovative RRI materials**; engage **more than 5200 teachers being registered in the project's on-line platform** (for downloading and commenting on the materials); engage **more than 350 teachers in participating in face-to-face workshops**, during which we trained them on practical RRI teaching strategies/tools – the “Dilemma lesson” and the “Group discussion” tools; implement **pilot studies for the on-line courses** on the above mentioned RRI strategies/tools . The vast majority of the partners reported only **positive feedback from teachers in the online community for the materials** as evident in the national ENGAGE web-pages.

2. OVERVIEW OF ADOPT

ADOPT is the first step of the ENGAGE continuous professional development (CPD) model. It *relates to the teachers' ability to use teaching materials which embed RRI-based teaching techniques, in order achieve students' productive outcomes*. ADOPT is followed by ADAPT, a transitional stage, in which teachers can use RRI teaching with less support, showing a significant change in either their beliefs, knowledge or classroom practice and being able to adapt materials and embed RRI ideas and strategies into their teaching. The last step (TRANSFORM) is the one where teachers are expected to undergo a shift in their professional self-image, for RRI teaching to be part of their repertoire.

In line with the ENGAGE step transformational CPD model, project work relating to the organization and the delivery of professional development activities has been structured around three work packages (WPs), each for each step, i.e. WP4 – ADOPT; WP5- ADAPT; and WP6-TRANSFORM. In terms to work relating to **WP4-ADOPT**, the *first year implementation* concerns the *period July 2014 till June 2015*, with the involvement of **11 countries of the consortium**: UK, Greece, Germany, France, Spain, Romania, Israel, Norway, Switzerland, Lithuania and Cyprus. WP4 is dependent on developments within WP1 (Framework), WP2 (Knowledge Hub) and WP3 (Resources) and collaborates closely with WP5 (ADAPT) and WP8 (Evaluation).

2.1.Objectives and goals of ADOPT

The ADOPT phase of the CDP model of the project aims to empower teachers use RRI techniques in everyday practice with the support of materials developed. For the ADOPT stage, RRI techniques focus on two teaching strategies/tools: the dilemma lesson tool and the group discussions tool (see section 2.2).

Teachers' involvement in the **ADOPT phase** of the ENGAGE CPD model *is expected to lead to the following learning outcomes and skills*:

1. Teachers are able to use teaching materials which embed RRI-teaching techniques and concepts;
2. Teachers understand the rationale for RRI techniques and their implications for classroom practice;
 - For the Dilemma lesson Tool: the goal is to understand the characteristics of an authentic RRI dilemma, to make the links to real life for the students, to promote the authenticity of the topic, evaluate the Dilemma as a way of framing the issue, science and skills for students.
 - For the Group Discussions Tool: the goal is to understand the purpose of the different group discussion techniques and forms.
3. Teachers are able to use RRI-techniques to engage students and achieve lesson outcomes, resulting in positive experiences which teachers have reflected upon;
 - For the Dilemma lesson Tool: teachers can describe how they engaged students in the issue and how they reached the goal.

--For the *Group Discussions Tool*: can describe different kinds of discussions that happened in their classroom.

4. Teachers can describe how they customised the materials to fit their students' and curriculum requirements, and reflect on how they kept the essential features of the Tool intact.

As per our contractual obligations, project work relating to the organization and the delivery of professional development activities within **WP4-ADOPT** has the following **objectives**:

- to attract a large number of teachers to embed RRI approaches through inquiry based learning in everyday teaching practices;
- to engage teachers get onto the path of RRI science, by acquiring the ability to use RRI teaching approaches so as to achieve productive outcomes.;
- to motivate a proportion of teachers propel from the "ADOPT stage" to reach the "ADAPT stage" in the progressive staircase of involvement;
- to test the model and its impact in Year 1, which will be re-iterated in subsequent years, and as the basis of subsequent stages (ADAPT/TRANSFORM)

The **specific targets** that we want to achieve by the implementation of the ADOPT CPD activities in each participant country – in the view of reaching the above-mentioned learning outcomes for teachers - are of both quantitative and qualitative nature: the **quantitative aspects** of the targets relate to the numbers of teachers that are expected to be engaged in each activity; the **qualitative aspects** of the targets concern the expected outcomes that we want teachers to achieve by the participation in each activity.

ADOPT targets from a quantitative perspective

- **Attract a minimum number of teachers (as in Table 1) to:**
 - Download the materials, to use them in the classroom, to provide feedback and to participate in the online community.
 - Attend the F2F workshop and to provide feedback on the materials and the RRI tools.
 - Participate in the on-line courses and to provide feedback on the materials and the RRI tools.
- **Ensure a proportion of teachers to propel** from the ADOPT to the ADAPT (at least 25% of the teachers using the ADOPT engage programme are expected to move towards ADAPT).

By the end of ADOPT 1st year implementation the partners in each country should have been able to:

	YEAR 1 ADOPT		
<i>Partner/Country</i>	<i>Materials</i>	<i>Online courses</i>	<i>Workshops</i>
FAU/Germany	700	25	30
SHU/UK	650	25	30
TRA/France	600	25	30
UB/Spain	450	20	25
VUT/Romania	200	20	20
FOR/Greece	100	15	20
WZ/Israel	80	15	15
HIV/Norway	50	15	15
DICS/Switzerland	40	10	10
LEU/Lithuania	40	10	10
UNI/Cyprus	20	10	10

Table 1: Minimum numbers of teachers targeted to participate in ADOPT activities for year 1
(period July 2014-June 2015)

ADOPT targets from a qualitative perspective

From a qualitative perspective by the end of ADOPT 1st year implementation the partners in each country should have been able to meet the following challenging targets:

- Ensure that **teachers are able to use RRI techniques/tools (productive dilemma and small group discussion)** with the support of our teaching materials in order achieve students' productive outcomes, by:
 1. Providing teachers using the materials with advice through the online community (materials activity)
 2. Providing teachers with F2F and online support in order teachers to achieve the expected learning outcomes as described in APPENDIX (F2F workshops and online courses activities)
- **Ensure that proportion of teachers that are willing to move to ADPAPT** have achieved what we have defined as level n3 in the RRI integration model, i.e. that their integration of our Topicals materials goes beyond motivational and casual use and has a purposeful intention in the curriculum

2.2.ADOPT CPD activities

The ENGAGE CPD model is based on the deployment of 3 main activities: materials, courses and community (see Figure 1)

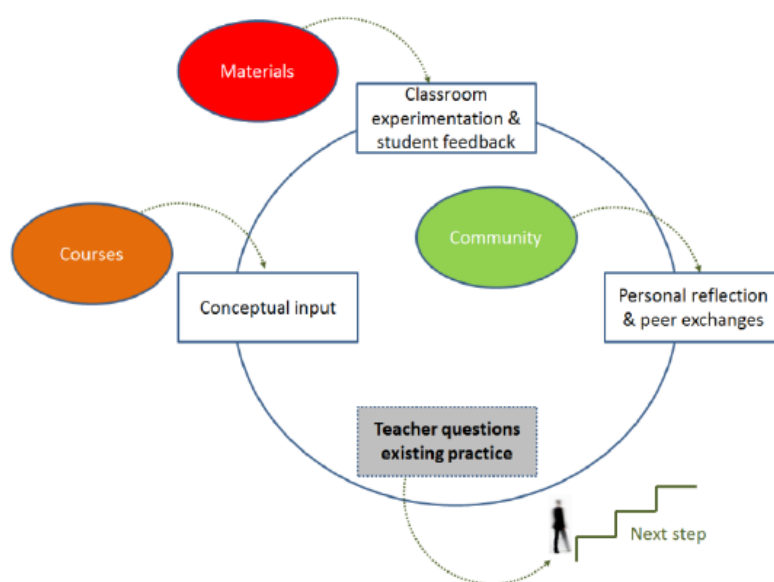


Figure 1: the ENGAGE CPD activities/strategies

Materials

The materials for the ADOPT stage (Topicals) are developed by SHU and focus on getting students to practice skills and knowledge already taught. This allows them to be short (from 20 minutes), and easy to fit into existing topics of the curriculum. The development of the Topicals take into account how teachers make decisions about choosing a new resource (for instance, they are likely to be teaching a topic with no practical, and which is difficult to enliven, so they are looking for an interesting angle, flexible enough to cater for a wide range of abilities and ages). The following **criteria** were taken into account in developing the materials for the ADOPT stage:

- **Curriculum link/learning objective:** Which topics fit in curriculum in partner countries, if it's a difficult/not interesting, and the content knowledge applied
- **Uniqueness:** Is the context one where science teachers have few existing resources or experiments?
- **Engagement:** Focus on engaging students in provocative questions they want to answer, with tasks that generate some conflict/controversy and challenge (to make them want to talk, express different opinions and encourage thinking, which together ensure the lesson gives teachers a 'good feeling' after - which will make them come back for more)
- **RRI knowledge (or Nature of Science/ Working Scientifically):** Which skill/knowledge in our 4 'RRI curriculum' areas (Evidence, Technology, Values, and Argumentation) is practiced?
- **Flexibility:** Can the context be easily shaped and adapted for different countries to maximize appeal?
- **Controversial:** The scientific phenomena or topic should invite a controversial discourse. Managing a controversial discourse in the classroom requires from the teacher other techniques to manage the class. Unlike 'traditional' discussions in a science classrooms – in RRI discussions there is no one 'right answer', teachers need to be aware of the differences between discussing scientific evidence and discussion RRI issues.
- **Inquiry:** The design should support students ability to raise inquiry questions and to the planning and conducting a process of inquiry.

By the end of June 2015, **20 Topicals** have been developed and are accessible in <http://www.engagingscience.eu/> website as open educational education resources (OER). A **list of the materials produced**, along with a short description is provided below:

What does the fox say? We use the viral video to raise a serious question: can we understand animal talk? 'Bowlingual' detects a dog's emotions by analysing a bark's sound waves. Students look at emerging research to decide what else the technology can do. Can we translate the sound waves into human speech?

Three parents. Babies will soon be born which have two Mums and a Dad! A new procedure which creates babies with the DNA of three people has just been given the go ahead in Britain. In this activity, students learn how it can help women with a serious inherited condition to have a healthy baby and why it is deemed so controversial. They use ethical arguments to decide whether they would recommend it to help a couple in need.

Grow your own body. As people live longer the demand for new organs to replace failed ones increases. One possible solution is to build new organs in a dish from cells taken from the patient's own body. Students use evidence from case studies to work out if this is possible and then to decide whether this new technology offers a good alternative to transplants.

Car wars. Imagine it is 2020 and students are about to get their first car. Increased carbon dioxide emissions have led to huge financial incentives to buy alternatives to petrol engines – but which car is best? In this activity students evaluate solutions and come to a decision on who wins the Car Wars.

Ban cola? Now that scientists have discovered that sugar is like an addictive drug, pressure is building for action to reduce the amount of sugar that children and young people consume in sugary drinks. In this activity, students consider the evidence for causal links between sugar consumption, obesity and disease. They then weigh up arguments for and against banning sugary drink sales to under-18s.

Attack of the giant viruses. Scientists have discovered a giant 30 000 year old virus still alive under the permafrost. As the world warms, others will be uncovered. Could such an ancient virus wipe out the human race? In this activity, learn how to interrogate sources to separate science fact from fiction.

Take the test? Genetic tests can be used to determine whether a person is a carrier of a genetic condition – but is having a test always the best thing to do? In this lesson the students are presented with an intriguing dilemma about whether a boy should have a screening test after his fiancée has found out she is a carrier of sickle cell disease. Students use information presented by experts to weigh up the options and come to a reasoned decision.

Ban the beds. In preparation for a summer holiday many people turn to sunbeds to top up their tan but could this habit be endangering their life? In this activity students are working as researchers on a TV show planning a report about the claim that sunbeds cause skin cancer. Students will use knowledge about UV light to explain the link between sunbeds and skin cancer, and understand how scientific evidence can support a claim.

Sinking Island. The Pacific island nation of Kiribati recently announced its purchase of land in mountainous Fiji for its population to move to when sea level rises make life on its own low-lying islands impossible. In this activity students use data to predict sea level rises, including uncertainties, and decide whether humans are to blame for climate change. If humans are to blame, then should the biggest polluters pay for land for vulnerable islanders to escape to?

Making decisions. Carriers of a inherited condition have to make many difficult decisions including what to do if they want children. In this activity students are placed in the role of a couple who are carriers of beta thalassaemia major. They are guided through how to make a difficult ethical decision and are introduced to IVF and the technology of pre-implantation genetic diagnosis.

Ebola. As Ebola continues its relentless progress across the world scientists are quickly developing drugs and vaccines to fight it. In this activity students are asked if they would trial a new Ebola vaccine. They gather information from different sources, weigh up risks and benefits and apply what they know about genes to decide if it is a risk worth taking.

Solar roadways. Revolutionary roads which stay snow-free, claim developers. A click of a switch they can transform the road into a car park or even sports pitches. In this activity students consider whether solar roadways are worth funding. They critique claims using reasoning and evidence, and apply what they know about generating electricity in solar cells, to make a decision.

Eat insects. As human population increases, our appetite for meat grows but very soon demand will outstrip supply. Farming large animals puts a strain on our natural resources and creates polluting waste. Scientists are proposing eating insects to help solve this problem. In this activity students are asked to plan a menu for the school canteen which contains tasty insect dishes alongside more familiar ones. Can they use persuasive communication, and their knowledge of natural resources, to get students to opt for the insect alternatives?

Appliance science. The EU has recently imposed limits on the power ratings of vacuum cleaners, and further limits on other appliances could soon be in place. In this activity students consider a further (fictional) future restriction, on home electricity use. Students calculate the energy transferred daily by the appliances they use. They are then set the challenge of deciding how to cut their personal electricity consumption – do they go for a shorter shower or banish blow-dries?

Chocolate money. Europeans love chocolate – we eat over half the world's supply! The bad news is that we are eating more cocoa than can be produced and soon chocolate may become a rare and precious commodity as farmers struggle to meet demand. In this activity students apply their knowledge of pollination to discuss why cocoa yields on a plantation are decreasing. They then find out who funds scientific research by taking roles in a funding meeting – can they work out a deal where all parties will benefit?

Big Bag ban. The EU has recently approved tough new measures to slash the use of plastic bags. New targets will force each country to reduce plastic bag use by 80% before 2019. In this activity students examine degradable plastic bags as a possible alternative to ordinary plastic bags. They choose questions to ask experts, and come to a reasoned decision in answer to the dilemma question: will degradable plastic bags solve the problems caused by ordinary plastic bags?

GM Decision. Following a EU rule change, the growing of GM crops across Europe will increase in many countries. It looks likely that GM foods such as breakfast cereals may be on our supermarket shelves within a year – but will many people choose them over GM-free alternatives? In this activity students apply their knowledge about genes to learn why crops are genetically modified before evaluating health risks to decide which cereal they would buy.

Text neck. New research suggests that smart phone use is seriously damaging our necks. Looking down at an angle places great strain on the spine, and can result in serious harm. In this activity students learn about the forces acting on the spine. They then devise a plan to investigate the causes of text neck, before solving a dilemma: will they use their phone less to prevent neck damage?

Invasion. Common ragweed, *Ambrosia artemisiifolia*, is an invasive plant which is spreading across Europe. Because of illness caused by its allergenic pollen and competition with crops, it's costing Europe an

estimated €4.5 billion a year. The solution may lie with releasing non-native beetles. In this activity students evaluate the advantages and disadvantages of using biological control to halt the invasion of this alien plant.

Life on Enceladus? Evidence from Cassini, a robot spacecraft, suggests that there are oceans of hot water on Saturn's icy moon, Enceladus. Might the oceans be home to alien life? In this activity students use their knowledge of the behaviour of water in its liquid and solid states to weigh up the evidence for and against the presence of liquid water on Enceladus. They then decide if it is worth sending a second spacecraft to look for alien life on this icy moon.

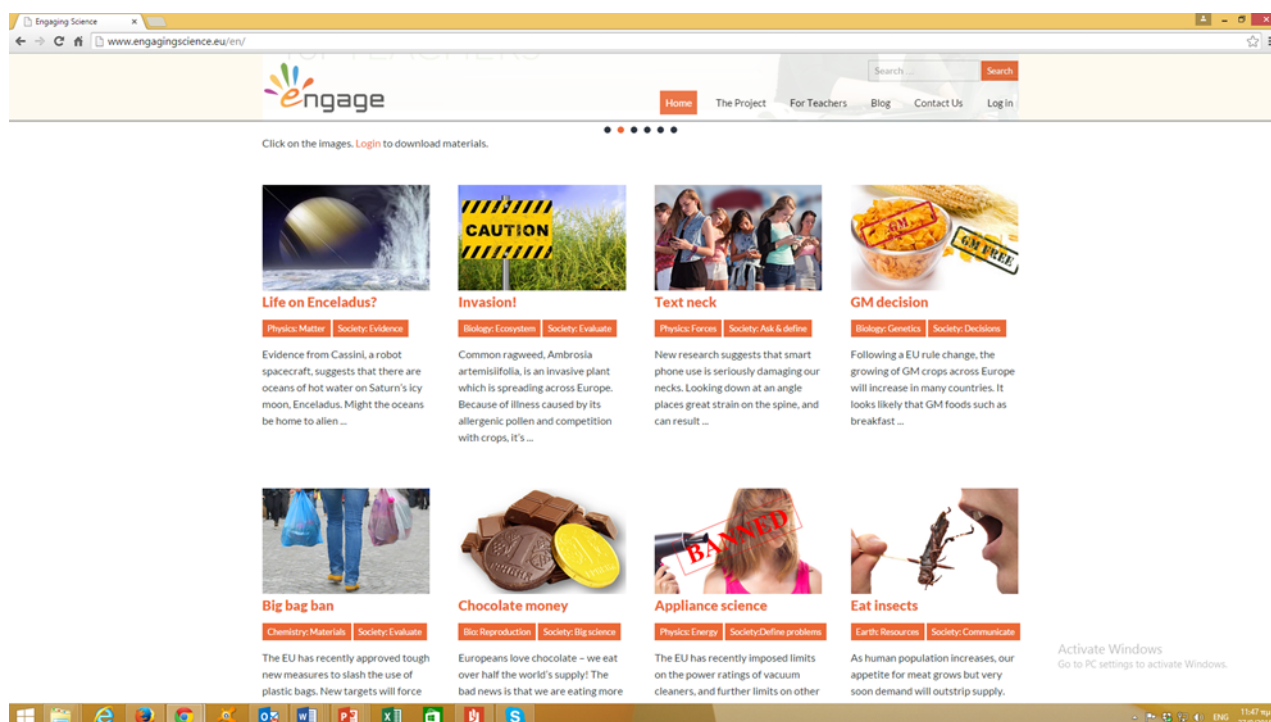


Figure 2: Screenshot from the ENGAGE website (Topicals published)

Each Topical consist of a power point presentation and a teacher's guide, while curriculum links and web-links relevant to the activity are also provided. Come of the **innovative elements** of the ENGAGE materials for the ADOPT stage, and the **anticipated benefit** for the teachers/students is provided in Table 2, below:

Innovation	Anticipated benefits
All in One Materials	Easy access, nothing to lose. Enables teachers to get TG without downloading.
Characters	Engaging starters, with dramatic scenario, motivating students to take role, and clarifying role of teacher. Engage students social intelligence
Interactive	Collect student understanding/difficulty statistics. More interactive lessons. Getting students ideas. Active starters and plenaries
Multimedia	Ipad friendly; Teacher menu for navigating resources; Integrated web-links/media, teacher guide/differentiated student sheets; Student-led version, using student

	devices
Scenarios	More non-linear flexible, section-drive lessons
Infographics	Visual, concrete and dramatic explanations, more active involvement for students

Table 2: Innovative elements of Topical and anticipated benefit for teachers/students

Workshops

The COURSES Strategy of ENGAGE uses a blend of online learning modules and face -to -face events (Workshops). Face-to-face workshops are based on the need to cater to teachers' needs for:

- learning directly from 'experts', with an intense focus;
- practice using the tools, and developing trust by meeting people behind the project;
- absorbing the whole programme in a single, time efficient event;
- building relationships with other teachers who share similar interests

Their key feature is they are experiential, where teachers able to try activities for themselves.

The **framework for the ADOPT Workshops** was developed within WP1 of the project. The framework describes each element of our CPD programme, and provides a clear objective and rationale for the strategies we have chosen. Its purpose has been to enable all partners to provide a similar, high standard of input to teachers' development.

In short, the **main goal of ADOPT Workshops** is to maximize the probability that teachers will use the 2 tools (dilemma lesson tool and the group discussions tool) when planning and delivering a dilemma lesson, and implement the tools accurately. In addition, we want to encourage teachers to progress further into ENGAGE, towards ADAPT. As stated in the previous section (Objectives and Goals), the focus for ADOPT is helping teachers to be competent using the activities and teaching strategies in the Materials. The ADOPT tools reflect the two distinguishing features of our materials: A lesson organised around setting up and resolving a 'Dilemma'; Students work on the Dilemma task in groups, through discussion (see Appendix I for a detailed description of the dilemma and the discussion tools). In short, core elements of the two ADOPT tools are the following:

- **Dilemma Tool:** We used the name 'Dilemmas' for ADOPT Materials because tasks focus around students intriguing questions which have no obvious right answer. Dilemma lessons are constructed in 3 stages, each with a different purpose. So the Dilemma Tool makes clear what is required of teachers and students in each stage to achieve engagement and learning.
- **Discussions Tool:** This tool provides teachers with practical techniques to ensure students can work together productively in groups. It takes a problem-solution approach to setting up groups, preparing students to discuss, and how to support them (N.B. learning argumentation is covered in ADAPT).

To achieve objectives and be consistent with the DoW means that the Workshops have certain ‘essential requirements’ for each partner’s delivery.

Essential elements of the workshops:

- Dilemma and Discussions Tools will be the focus of all workshops
- ADOPT Professional Learning Outcomes
- Workshop Session Objectives
- Participation time: minimum of 5 hours of teacher Face to Face participation

Other elements are ‘localised’ and designed to meet the needs of teachers in each country.

Localised elements:

- Marketing: which benefits/outcomes are prioritised in selling the Workshop to teachers
- Session Activities: activities and exemplars used with teachers
- Session Learning Strategies/Focus
- Workshop Organisation: either 1 full day or a number of shorter sessions

Vision for expert RRI teaching

The starting point is to describe what ‘practices’ we want from ENGAGE teachers at the end of the project. The DoW describes 5 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:

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 – see Appendix 1.

2. Explicitly teach ‘RRI skills and knowledge’ needed to deal with science issues:

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.

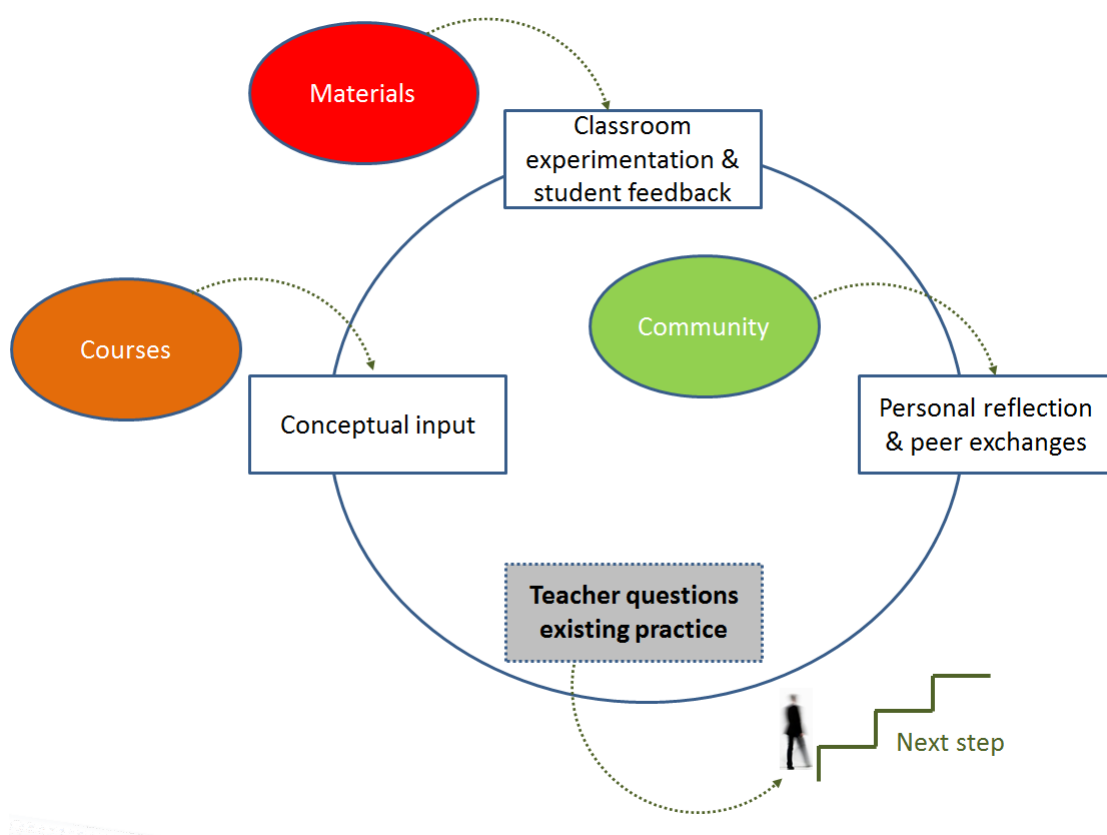
3. Use open dialogue to build students’ reasoning and understanding:

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.

Our **workshops' strategy** has two parts: *understanding* and *enabling teachers*. Thus sessions for each tool are constructed around these elements:

- *Understanding*: Introduce the purpose of the Tool & Break it down into 'chunks' and model each one clearly
- *Enabling*: Teachers immediately practice using each chunk and receive feedback; Explain the rationale behind the Tool, to enable flexible usage & Teachers plan how they will implement it back in school

The role of Workshops in teacher inquiry



An effective professional development programme also needs a 'theory of action' – a hypothesis for how we expect ENGAGE actions to cause these outcomes to happen. In the DoW we described teacher learning as a complex system (see diagram above), where multiple conditions need to work together over a long period to create change. We want to stimulate teachers to be 'active inquirers' - motivated to learn how to teach science using issues.

Materials start the inquiry process, giving teachers positive experiences in the classroom, and raising questions in their minds about how and why the approach works. The Workshop (and Online Courses) help

to answer these questions, with practical and theoretical input on how to maximise engagement and learning.

Workshop Outline

The Adopt Workshop Outline has been designed by asking and answering the following design considerations:

1. **Purpose** - *define a specific goal for the activity, based on the overall outcomes for Adopt*
2. **Learning outcomes** - *define what are teachers expected to do by the end of their learning*
3. **Teaching strategy** - *choose an appropriate teaching strategy*
4. **Resources and ideas** - *decide what is needed, including Materials and Video Library*
5. **Assessment** - *define how to assess/evaluate teachers' learning*

The workshops were structured as an **understanding and enabling activity**. Teachers were introduced to concepts and apply what they learn immediately to create a product. This was their version of a Dilemma lesson which will be produced collaboratively with support from the engage tutors and peers. The outline of the ADOPT workshops is provided in Table 3 below:

Time	Session title	Description of activity (Type)	Purpose/Learning outcomes (Focus)
15mins	Introduction	Pair conversations to introduce each other Group feedback on key aims (2)	Participants articulate their intended outcomes from the programme for themselves, their school, their pupils
20mins	Experience a dilemma	Initial warm up activity Groups are presented with a socio-scientific dilemma and challenged to make a joint decision in 15-20 minutes, through discussion. (6)	Stimulate and excite participants, engage in learning Participants will: Experience the use of evidence and argument to reach a decision Identify opinions, evidence and objectiveness (2)
20mins	Why teach socio-scientific issues?	Reflection on the experience, and benefits for understanding science, inquiry, attitude and ability to use science in their lives. Relate this to teaching experience, list	Persuade teachers of the value of teaching this way.

		advantages/disadvantages of the approach. (3)	Participants will: Develop understanding meaning of a socio-scientific dilemma Identify contribution to teaching and learning (5)
15mins	Introducing Engage aims and overview	Brief Engage overview: <ul style="list-style-type: none"> • aims • Engage Model and its components • Goals for Adopt Stage • Description of Workshop sessions and role Introduce the Tools that are the focus of the day: <ul style="list-style-type: none"> • Dilemmas • Discussions (1) 	Presenter talk using prepared slides to set out the content and purpose of the workshop Participants will: Understand the purpose of the workshop, agenda and their contribution to the outcomes (1)
30mins	Productive Dilemma Criteria (Dilemma 1)	Show and discuss the criteria and checklists, and then get teachers in groups to use them to evaluate the Summaries teachers brought along from the Pre-Course Task, as candidates for 'This week's Dilemma' Challenge teachers to 'craft' the issue to meet all the criteria and checklist items, and complete a 'Dilemma outline' template. Engage examples available for comparison. (3)	This activity provides a link to the pre-course task and introduces the dilemma checklist. Teachers will develop the use of this checklist in subsequent tasks. Participants will: Identify and understand the key elements of a dilemma lesson Begin to see how the lesson has to be built and crafted to cover all aspects and be a distinctive dilemma lesson. (2)
60mins	Teaching a Dilemma Lesson	Introduce the 3 stage lesson model, step by step. Stage 1: Dilemma <ul style="list-style-type: none"> • stimulus 	This activity will lead teachers through the dilemma process in detail. In each step teachers will translate the theory to practice by planning their approaches to the teaching activity.

		<ul style="list-style-type: none"> dilemma question <p>Stage 2: Student task</p> <ul style="list-style-type: none"> review science consider options/issues <p>Stage 3: Plenary</p> <ul style="list-style-type: none"> revisit dilemma question assessment for learning <p>At each stage, set teachers the challenge of developing the content for 'This Week's Dilemma', working out what will happen in that stage of the lesson. Introduce and use the checklist against each stage in the process. (8)</p>	<p>Participants will:</p> <p>Understand the three part dilemma lesson structure</p> <p>Relate the theoretical perspective to concrete teaching activities. (2)</p>
60mins	<p>Structured discussion techniques</p> <p>(Discussions 1)</p>	<p>Introduce, demonstrate and compare discussion techniques.</p> <p>Teachers simulate using techniques (group work) and then choose which one will work best for 'This Week's Dilemma'.</p> <p>(3,8)</p>	<p>This activity will introduce key teaching skills and pedagogy for dilemma lessons.</p> <p>Participants will:</p> <p>Be aware of a range of strategies for managing effective discussions</p> <p>Understand how to structure effective discussions</p> <p>Apply criteria to select appropriate approaches (1)</p>
60mins	<p>Effective group characteristics</p> <p>(Discussions 2)</p> <p>(this session could be combined with previous session)</p>	<p>Introduce research on prerequisites for effective discussion, leading to need to teach skills, and set up rules and norms.</p> <p>Provide exemplar activities on teaching listening/contributing skills, which teachers simulate using examples from Engage materials.</p> <p>Teacher task could be to create a checklist for group work. (3)</p>	<p>The aim of this session is to show teachers that the approaches and strategies are based evidence based and to illustrate the related pedagogy.</p> <p>Participants will:</p> <p>Be familiar with the research evidence relating to group work</p> <p>Understand key skills and approaches for group work (1,5)</p>

30mins	Review - Customise Dilemma Materials	<p>A set of guidelines on how to make a 'principled customisation' of the Adopt Materials.</p> <ul style="list-style-type: none"> any change to the real-world issue, dilemma question, science content, or RRI skills meets the criteria for Productive Dilemma any changes to the student task address the principles in the Group Discussions Tool. there is an effective and efficient lesson structure for the Dilemma (3) 	<p>This session will focus on supporting teachers to plan their use of Adopt materials in the classroom. It will encourage teachers to think about localisation and tailoring materials for their teaching.</p> <p>This session will also review learning from the day.</p> <p>Participants will:</p> <p>Review lesson structures and organisation for teaching dilemmas</p> <p>Develop and outline plan for a dilemma lesson (1,2)</p>
10mins	Plenary and action plan	<p>Reflection on personal outcomes from the course programme. Introduce post course task and enable teachers to produce an action plan for implanting and completing this task.</p>	<p>Participants will:</p> <p>Evaluate learning from the course</p> <p>Plan next steps for their development</p> <p>(1,2,3,6)</p>

Table 3: Outline of ADOPT workshops

On-line courses

The choice of online course as a key strategy within ENGAGE is based on the need to:

- build in 'conceptual inputs' (a process in the teacher learning cycle) · enable teachers to learn 'just in time', choosing a module when they are ready
- minimise time out of school
- easily replicate quality across partner countries (a train the trainer model can dilute impact)

As in the DoW, ENGAGE will produce 3 on-line courses, whose objectives matches the learning defined in each stage of ADOPT, ADAPT, and TRANSFORM. Module 1 refers to the ADOPT stage. This **module is an online version of the F2F Workshop, with same purpose and similar content**. It gives teachers highly valuable 'take-away': learn RRI strategies through a video library demonstrating how expert teachers make them work. Each on-line course lasts 3-4 weeks, with one topic and task set per week.

In short, the **aim of the online course** is to extend the workshop experience as well as provide an introduction for those who could not participated in the workshop. ENGAGE online courses support teachers by:

- Providing simulated practice for teachers, in a supported atmosphere of experimentation learning directly from 'experts'.
- Focussing on successful use of curriculum materials with feedback, which will be given by the course facilitators.
- Practicing using the strategies through simple tasks based on teacher's needs, interests and efficient time.

By participating and completed the online course teachers:

- develop an awareness of the ENGAGE Tools
 - Productive dilemmas: definition, criteria and use in classroom teaching
 - Group discussion: definition, methods, moderating group discussion in classroom teaching
- have an opportunity to explore the Open Education Resources developed by ENGAGE
- consider a range of teaching and learning strategies that support the teaching and
- have the opportunity to work collaboratively to develop an ENGAGE lesson

All the above mentioned activities within ADOPT (materials usage, workshop attendance and on-line participation) should not be seen in isolation of the broader CPD framework; rather they should be anticipated within the context of the step transformational CPD model (ADOPT-ADAPT-TRANSFORM), by creating the conditions to support teachers move towards the next step, i.e. ADAPT.

3. IMPLEMENTATION OF 1st YEAR ADOPT

This section provides an overview of the first year implementation of ADOPT in *11 countries* of the consortium (UK, Germany, France, Greece, Romania, Spain, Israel, Norway, Lithuania, Switzerland and Cyprus). First year implementation of ADOPT refers to the **period July 2014 till June 2015**.

The section is structured around the main activities that ADOPT involves (Materials, Workshops, On-line courses), in order to highlight progress and outcomes against targets in each activity. Short reports on ADOPT implementation per country is provided in APPENDIX 2.

3.1. Coordination and monitoring of ADOPT implementation

The coordination and the monitoring of the implementation of the ADOPT in the 11 countries followed the guidelines reported in D4.7 (Adopt dissemination and networking plan). On the one hand, this document aimed at **guiding and facilitating** the ENGAGE **consortium in preparing the dissemination and the implementation** of ADOPT activities. On the other hand, D4.7 aimed at facilitating partners achieve the challenging targets of the ADOPT phase of the CPD of the ENGAGE project, **by providing them with recommendations and guidelines on how to monitor what is happening in their countries** during the implementation of the dissemination plan and how they will have early feedback by teachers in order to avoid poor results during implementation (for both quantitative and qualitative perspectives).

As described in detail in D4.7, coordination and monitoring was conducted via ASANA – in which partners created their ADOPT dissemination and implementation projects. During the 1st year, **specific attention was given by to the countries which had challenging targets in terms of engaging large numbers of teachers and in which initial dissemination plans did not provide the expected outcomes and needed refinement**. For these countries an online questionnaire for reporting activities, outcomes against targets and problems/challenges was distributed by the coordinator separately from the other partners. Discussions via emails and during the weekly online meetings also took place, with a view to identify problems and provide solutions. At the end of the reporting period partners were asked by WP4 leader to provide reflections on their dissemination strategies (successful elements, challenges faced and proposed actions for future) (see Appendix 2 in each country report and section 2.6 for an overview).

The users' comments on using the materials in the on-line community have been collected by WP4 leader, with a focus on the ones requesting refinements. We are currently in the process of cooperating with VUT partners on how these comments will be addressed for the 2nd year of implementation, in the frame of T4.3 (on-line content for reflection, updating the Knowledge Hub based on T4.1 and T4.2).

3.2. Interdependencies for ADOPT implementation

For the successful implementation of the activities of the ADOPT stage (materials uptake, workshop attendance and on-line participation) WP4 deployment is mainly dependent on developments within WP1,

WP2 and WP3. The following table summarizes the interdependencies among activities across these work packages, in order to provide a global view of the context within the project on which the WP4- ADOPT has been implemented.

Activity with ADOPT WP4	Minimum requirements for implementation – WP#	Delivery
Materials uptake	Topicals development and publishing as in schedule – WP3	On-time as in schedule
Workshop attendance	Framework and Content of the workshops, development of the ADOPT tools (dilemma & discussion tool)-WP1	End of March 2015
On-line participation	Framework and Content of the on-line courses, development of the ADOPT tools (dilemma & discussion tool)-WP1	End of March 2015
	On-line course production –WP2	September 2015

Table 4: Minimum requirements for ADOPT implementation

3.3. Materials uptake

As in the DoW, a minimum number of teachers in each country has been expected to download the ENGAGE materials of the ADOPT phase in the 1st year, use them for classroom experimentation, participate in the online community and provide feedback about the outcomes of the usage. Table 5 provides an overview of materials uptake against targets.

	YEAR 1 ADOPT –Materials uptake (by June 2015)		
Partner/Country	Target	Users in the platform	Comments
FAU/Germany	700	108	7755 downloads (4832 on the teachers-online page (a cooperation partner) and the rest from the ENGAGE Germany page. Until the end of May all materials could be downloaded without previous registration. We estimate that about 2000 Users downloaded the materials (analysis of the IPs)
SHU/UK	650	3.600	More than 4144 downloads (the number refers only to the 5 most popular materials)
TRA/France	600	101	367 downloads
UB/Spain	450	423	2051 downloads. By 31 st of August 2015: 452 teachers signed up

VUT/Romania	200	183	More than 960 downloads (the number refers only to the 5 most popular materials)
FOR/Greece	100	82	50 downloads
WZ/Israel	80	432	73 downloads
HIV/Norway	50	90	More than 143 downloads (the number refers only to the 5 most popular materials)
DICS/Switzerland	40	42	300 downloads
LEU/Lithuania	40	203	3823 downloads
UNI/Cyprus	20	15	35 more users by September 2015
TOTAL	2930	5279	

Table 5: Materials uptake against targets

As evident in Table 5, in total the quantitative targets in terms of materials uptake has been reached, as **more than 5200 users** have been register in the ENGAGE platform and have downloaded at least one Topical. Materials uptake in terms of numbers seems to be **most successful in UK** – as it might have been expected due to the experience of UK partners in recruiting teachers (upd8 project). **Israel, Norway, Lithuania, have also managed to over-reach their targets** in users registrations, while **Switzerland achieved the minimum target. Spain, Romania, Greece and Cyprus recruited more than 75% of users** comparing to the initial target (with Spain managing to reach the difficult target of 450 users in August '15). Monitoring activities within WP4 (see D4.7) and communication with WP4 leader and project coordinator, resulted in the refinement of the initial dissemination plans in these countries so as to reach broader audiences. Refined dissemination plans and the experience gained in the 1st year, will be helpful in the 2nd year of deployment of ADOPT.

Germany and France recruited less than 15% of users comparing to the initial target. However, according to the Germany partner: *“Until the end of May all materials could be downloaded without previous registration. We followed this approach due to the very strong renitence of German teachers on giving away their contact (e-mail) to a project. So the focus was on building trust. We estimate that about 2000 Users downloaded the materials (analysis of the IPs). End of June all materials were uploaded: Only registered people could download the materials. The amount of downloads decreased a lot.”*

“We reached the target of getting more than 700 teachers involved (the number of downloads is very high) but a low number of registrations. This is a particular situation due to the fact that in Germany teachers are not used and willing to register and give feedback to a portal they don’t know yet. That is the reason why we first tried to build trust by involving a) a partner organization (Teachers-Online with a community of 500.000 Teachers) and b) materials could be downloaded without registration. Now we are developing more dissemination materials (project trailer, short flyer) in order to increase the number of registrations.”

This feedback calls for reconsideration of initial plans for dissemination and for localization of dissemination activities, taking into consideration experiences from Year 1 deployment in the country.

Communication with the French partner on April 2015, in the course of monitoring activities within WP4, provided the following feedback: *"At today, the French Engage website has 2500 single visits, showing a quite good visibility of the website. Of these, only 19 teachers have actually registered, giving an engagement rate of 0,76%. This low rate can be ascribed to several factors, and we do not have at present enough elements to provide a solid answer (...). Traces strategy to engage teachers is organised in two main strands: To ensure long term inscription of the ENGAGE project and material in the teacher CPD through a structured partnership; To directly advertise the resources through existing teacher and science networks, and online vectors. Based on the (...) consideration on the French systems, we have initially decided to value the first element that is the structuring of a trustful partnership with relevant key players. However, some delay on our side, and the time lengths needed in establishing partnerships, also needing concrete materials available to guarantee the quality level of the proposal, has proven the initial strategy non-adapted to the strict deadlines needed for the project. The direct "marketing" to teachers and teachers' network will be intensified. It is expected that this will produce a constant increase of teacher engaged in the project, with a peak that will be achieved after the summer break, thus displacing slightly the deadlines set in the DOW".* Efforts from the French partners resulted in increasing the number of the users till the end of June, but being far from reaching the challenging target of 650 users. Current (September 2015) report from France highlights that "dissemination strategy has already been modified" (see Appendix 2-France)." An extra collaborator was hired to work specifically on dissemination. An external company, specialized on educational networks and on-line resources, has been subcontracted. A massive campaign will start at beginning of October 2015."

Most popular materials in each country

The following table provides an overview of the materials that have been mostly downloaded in each country. This overview could be helpful to partners in each country for disseminating ADOPT in the 2nd year, by focusing on the materials which seem to be most popular in their countries.

	GER	UK	FR	ES	RO	GR	ISR	NO	SWIT	LITH	CY
Life on enceladus?											
Invasion!								X			
Text neck											X
GM decision				X	X			X			
Big Bag ban				X							

Chocolate money			X						X		
Appliance science				X				X			
Eat insects			X			X			X		
Solar Roadways				X		X		X			
Ebola	X	X				X	X		X		
Making decisions							X				
Sinking Island	X				X						X
Ban the Beds			X		X					X	
Take the test?	X		X	X							
Attack of the giant viruses		X	X				X		X	X	
Ban Cola?	X	X			X		X	X	X	X	X
Car wars		X								X	X
Grow your own body							X				
Three parents	X	X					X	X			X
What does the fox say?					X					X	

Table 6: Most popular materials in each country

In the whole, among the most downloaded materials are: Ban cola? ;Three parents; Attack of the giant viruses; Ebola. Life on enceladus is the only material which has the least downloads, as it might have been expected since it was the last material developed in year 1 (published in May 2015)

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Feedback from teachers in the on-line community

The **vast majority of the partners reported only positive comments** on the materials by users and no negative comments at all. In addition it seems that many teachers are using the materials for **14-16 rather than 11-14**, perhaps because it is quite challenging to use the decision making (RRI) skills. **As in teachers' comments, main characteristics of the materials** are the following:

- Engaging for teachers and students;
- Well-presented;
- Relevant to students;
- Provoking various dilemmas;
- Encouraging critical thinking;
- Making learning fun;
- Relevant to the curriculum and to everyday life.

Some examples of **teachers' positive comments** follow:

Take the Test: This resource engaged a class of Year 8 boys – it was well presented, easy to navigate around and some of the slides were useful as worksheets. Setting the science in context helped them to understand the importance of pedigree diagrams and has given them an excellent platform for GCSE Science when they study this for their exams. The issues/dilemmas of taking a test, the ignorance of some and possible prejudice of others gave the series of lessons an extra dimension for the boys to hook their knowledge and understanding of genetic inheritance.

Appliance science: very interesting activity. It is relevant to all teen-agers in different levels of scientific knowledge. It exposes the teens to scientific concepts and make them think about the topic from a different point of view then that of their daily life. This activity provokes various dilemmas and encourages critical thinking and decision-making

Chocolate money: interesting topic

I am a teacher and chocolatier. I often uses chocolate as an example to many topics. I will use this activity in the classroom to show other directions. Thank you for the new information

GM decision: This activity is based on students' sharing their own ideas and views. Learning is fun and not boring. It is relevant both to the curriculum and to daily life. The teacher need a good background on genetic engineering. Relating to this activity – more scientific information for the teachers is needs

Three parents: interesting, relevant, and enriches students' knowledge. Some former information is needed for meaningful learning and for making a well-reasoned view

Ebola: A very interesting and relevant activity. It is in the media recently. The activity presents the dilemma very clearly, provides facts on Ebola virus and vaccine. Then students' are provided with various views and sources as well as a clear way to consider pro and cons and make a decision whether to take the vaccine or not.

Car wars: The activity is really nicely combining the problem of air pollution and global warming. The students hear a lot about these topic but the dilemma of buying a car is a nice application of the consequence for decision making – How to save energy, how to use energy efficiently and in a less polluting manner. The topics of energy, ecology and global warming are well weaven together. Cars is a topic that "speaks" to the students.

Grow your own body: very interesting dilemma. Need more scientific background. Can be combined with another dilemma of organs donation

Making decision: An activity with clear goals. Provides a variety of teaching strategies: cards, videos, working in pairs, thinking individually. It requires high order thinking skills, and understanding of scientific processes. Thinking and decision making are well guided and structured

Ban the beds: I loved the activity. The graph presented was a bit too difficult to understand.

A few *refinement remarks* have been reported by partners in relation to the materials, which will be taken into account in the delivery of year 2 ADOPT by materials developers (WP3):

Chocolate money: this activity is suitable also for younger using a specific video is recommended, adding more biological information, a suggestion for classroom activity: composing riddles on the topic.

GM decision: more scientific background for the teachers is requested

Take the test: A few comments regarding the Power point presentation: the goal of the activity is not clear enough, more information about the asked questions and possible answers is required. Some slides are overloaded

Car wars: More scientific issue about the different fuels and about the volume of CO₂ that is expelled is needed.

Make decisions: The power point is not organized conveniently. The cards should be divided from the presentation, also not clear what is the teacher role in the cards activity

The attack of the giant viruses: I would like to make a small contribution.

The table gives criteria for deciding whether a product is reliable or not, it is said to be unreliable when using the words "could", "might" ...

I think a newspaper article or even an investigation can use these expressions, for example in the conclusions, as we can tell that have opened some new hypotheses that are "credible".

In conclusion, I would change the criteria by: "plausible and testable hypotheses arise."

What does the fox say? I have the problem that the reproduction of slides on Open Office doesn't work well. The worst thing is that I cannot hear the audio.

Ban cola: The word "ban" is not well received by a teenager ...

In addition, we will make fewer sugary drinks consumed or will promote consumption of drinks with sweeteners?

GMO: I believe that the evidence that provide for and against the use of GMOs in the material are very high bias in favor of GMOs that borders on the bias. I think it's very important to generate discussion among students presenting honestly all data and opinions of prestigious scientists, not indoctrinate.

Solar roadways: Very interesting about a subject that seems to have aroused much controversy activity ... I share some links I found by doing a not very exhaustive search which can be used for further information (especially for teachers)

The **Romanian teachers'** comments were generally related to the fact that they cannot implement the ENGAGE activities into the classroom as these have been designed, due to the Romania strict curricula content and to the limited number of hours at the teachers' disposal. They had to pick up only parts of these activities and tried to introduce them when the time allowed them. In **Cyprus**, during the face to face meetings the teachers suggested changing the materials to make them more inquiry-based.

3.4. Workshops

As in the DoW, a minimum number of teachers in each country (see Table1) attend the 1 day F2F workshop, aiming at introducing and engaging teachers to our RRI materials and the online community and at making them aware of RRI teaching techniques/tools -their rationale, characteristics, expected outcomes – i.e. productive dilemma and group discussion. The following table provides an overview of participation in workshops against targets.

Partner/Country	YEAR 1 ADOPT –Workshops		
	Attendance (Targets)	Implememation	Participants (total)
FAU/Germany	30	<i>Scheduled for 20/10/2015 and 23/10/2015</i>	-
SHU/UK	30	9/1/2015; 7/5/2015; 30/6/2015; 1/07/2015	35
TRA/France	30	8/4/2015	7
UB/Spain	25	9/3/2015; 5/5/2015	78
VUT/Romania	20	6/6/2015	25
FOR/Greece	20	16/05/2015	28
WZ/Israel	15	25/5/2015; 13-16/7/2015	37
HIV/Norway	15	5/6/2015	18

DICS/Switzerland	10	9/5/2015	17
LEU/Lithuania	10	1/4/ 2015; 2/4/2015	94
UNI/Cyprus	10	3/4/2015 ;13/05/2015	19
	180	17 workshops	3578

Table 7: Workshops implementation against targets

As evident in Table 7 all countries expect Germany¹ conducted the ADOPT workshop (see section 1.2 for the workshops outline) and successfully met the quantitative targets set in the DoW (numbers of participants). In the whole **17 workshops took place** and **more than 350 teachers** were engaged in workshop activities focusing on using Topicals via the dilemma lesson and group discussion tools. Main outcomes of the workshops are reported for each country below.

Outcomes of the workshops

UK:

The workshops provided opportunity for teachers to practice dilemma scenarios and also investigate group discussion skills within a supportive environment. As an integral part of the sessions teachers planned out how they would use and implement Engage materials back in their own classrooms and encourage wider dissemination.

Spain:

Workshop 1:

- Most participants think that these are useful and valuable materials for attracting students' interest in science lessons nowadays. The materials have led to discussion among the participants, especially regarding the science content, such as the importance to restrict energy use to avoid the greenhouse effect (appliance science), and the need to reuse or recycle plastic bags (big bag ban).
- Participants thought of ways to include these materials in their lessons, the challenges they would face and how to overcome them.
- Participants are interested in receiving more training.

Workshop 2:

- Participants agree that ENGAGE materials can help students understand that science has implications in their daily life, which may increase their motivation to learn science

¹ The patener from Germany reported: "The workshop will take place on the 20. and the 23.10, not earlier because the materials were not ready before the summer break. Workshop takes place during the Autumn break."

- Participants were keen to behave as students and go through the steps of the ENGAGE materials demonstrated
- Participants highly appreciate to learn classroom strategies to make their science lessons more appealing and engaging to students. The steps and tips to organise and carry out a group discussion were perceived as very useful because as science teachers, they are not used to organising discussions in class.

Romania:

Most teachers from the target group (71%) think that the connections between science and everyday life represents the achieved element during the workshop with the greatest impact on the learning activities of students, while 13% of teachers give the highest importance rate to the training / development of investigative skills, 5% of the teachers give the highest rate to the training / development of resolutive skills and the remaining 11% of teachers appreciate that the most important aspect they learned is related to the students' involvement in decision-making process during the Science lessons. These responses demonstrate, once again, that Science teachers from Romania acknowledge the need to reform the teaching of scientific disciplines, in line with European Community policies and with the new type of citizen that must be trained by the contemporary education.

Greece:

Teachers were really engaged in both tools and provided positive feedback on the evaluation. Despite being an intensive one-day workshop they stayed till the end and were engaged in very lively discussions both on the dilemma tool and the discussion tool. Teachers planned out how they could use Topicals in their own classrooms.

Israel:

Main outcomes were teachers' awareness to the following topics: 1) presenting socio-scientific issues, 2) discussions 3) argumentation. They acknowledge that these are important but tend to work according to the formal curriculum and not use ENGAGE materials as is.

Norway:

The participants were happy with the course and found the tools useful

Switzerland:

The workshop helped to have Engage more publicly known (there were several hundred participants in this congress about sustainable development). One participant that works at the pedagogical school in Bern has contacted us recently and asked us to organize a workshop for German speaking high school teachers in April 2016. This is very positive!

Lithuania:

All the seminars were quite successful. We organized the first seminar in January 23, 2015. On the demand of science teachers, especially belonging to the Association of Biology teachers of Lithuania, we organized two more seminars in April, 2015. We organized every seminar in two parts: the first half of a day was devoted to theoretical part (introduction to the ENGAGE project, explanation of ENGAGE tools, introduction to the website and materials created) and practical part for the second half of a day in computer classes (presenting the materials published on the ENGAGE website and explaining the concepts of their creation; working in groups for trying the materials simulating students' class situations). It seemed that materials created with RRI and dilemma aspects were very successful and could be used for students' motivation in the class

Cyprus:

The most important comment that came out from all the teachers is that the workshop and on-line materials are useful, but they would prefer if they had time during the workshops to collaborate with other teachers and design their own materials that they can use in their classes specific to their curriculum. So they actually want to be designers themselves. We are actually implementing this as an activity in the workshops that will take place in fall.

3.5. On-line courses

In year 1 of the ADOPT phase, the consortium managed to implement 2 pilot online courses, with plans to run the courses between November and December 2015 (see Table 8 for dates per country). There is evidence that efforts have been made by WP4 leader for the in-time implementation; however the deployment of the on-line courses was dependent on a thorough DPD framework, which was something not fully anticipated in the DoW, it was complex and which took much time and much partner collaboration. The consortium is currently catching up by developing CPD frameworks for ADAPT/TRANSFORM together, which have been currently already finished, so that the other courses can be rolled out without further delay.

Pilot online courses

The adopt phase had a total of 2 online courses tested with members of the consortium, pre-service and in-service teachers.

The first course refers to the ENGAGE Pre-Pilot, which was organized during 6th to 30th of April. Participants who registered in the course were ten members of the ENGAGE consortium and ten pre-service teachers from Romania (VUT). Various technical problems were listed: Error 500 EdX Platform, teachers could not upload images, problems with connection, difficulties to access the course.

As reported by VUT, the Romanian partners enrolled in this pre-test on-line course 10 prospective teachers (students who will become teachers). Only 5 of them completed the course. The main reason was concerned by the difficulties encountered by the participants to login to the edX platform, to enter in the space dedicated to the on-line course and upload their tasks. Due to this reason UVT kept the connection with Lattanzio Learning, Italy (who administrate the edX platform) and Open University, UK (the partner responsible for MOOC organizing) and communicate all the technical difficulties. Consequently, Lattanzio Learning partner decided to reinstall a new version of edX platform during 15th of April – 15th of May.

Participants' answers to the question "What were the most useful activities?" comprised the following: presentation about dilemma lesson, presentation about group discussion, and the forum discussion for planning a lesson. 85% of participants considered that the use of ENGAGE activities will make the lessons more enjoyable and fun for students. However, participants agreed that in order to implement such kind of materials into the Science lessons request more time than normal teaching activities and a higher effort from the teachers' part to plan and follow the lesson activities.

To the question "Any other comment? What can we do better next time?"

1. I was not able to do complete the course. The 500 error not allow me to work properly.
2. Yes, I and my colleagues had a lot of problems to enter in the on-line course space. We had a lot of errors when we wanted to log in.
3. I like the course, but the tasks are very ambiguous.
4. Suggestions: a) reminder e-mails; b) more time for assignments; c) keep the course interesting.

Concerning what are the participants' suggestions for the course improvement, these were the following: More practice examples; to resolve the IT problems with the platform; more interactivity; I think that the tasks are ambiguous, and the site is very complicated; increase the connectivity between learning materials presented each week by reinforcing cohesive themes in the course structure.

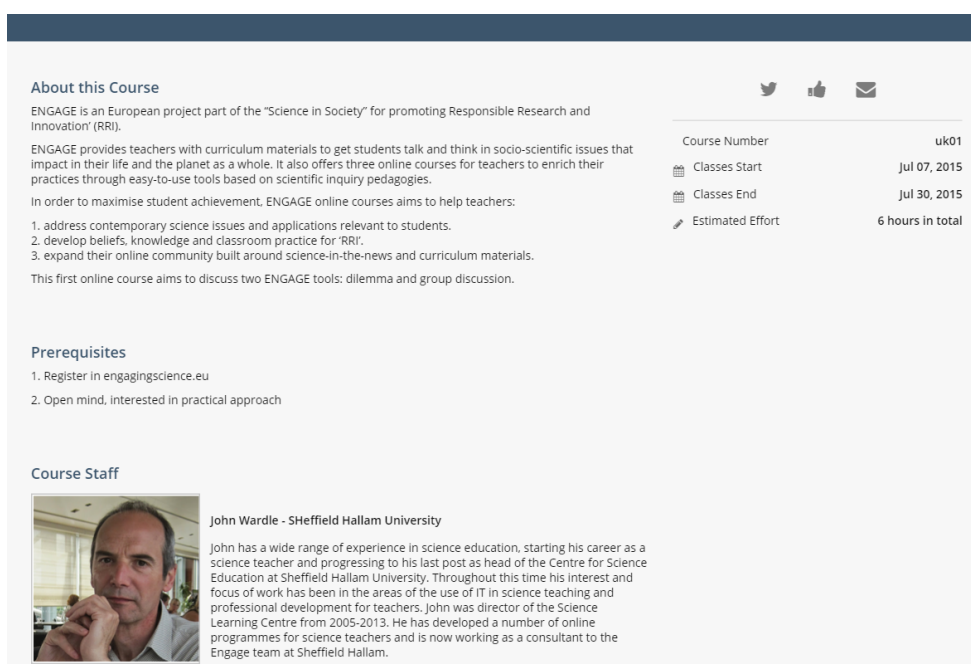
The most pregnant problem encountered not only by the participants but also by the tutors during the pre-test course period was the "500 error" given by the edX platform.

The most important goal of the pilot course in Romania was to emphasize the possible difficulties that participants can face during the course activities. If we look at the participants comments we can say that the goal was achieved, because with the help of the participants we could identify what are the technical problems and what do we have to do in order to solve them, what are the most useful activities (parts) of the course from the participants' point of view, what are the parts of the course that are not very clear for the participants and should be polished. However, we also have to take into consideration that participants involved into the pre-test course didn't have a great experience of teaching, they are prospective teachers involved only in some practical activities into the classroom during the specific "Teacher training Module" activities. Probably this aspect can explain in a certain measure some of their answers.

In addition, we have to underline that RRI is a new thing for all the teachers and teachers' educators in Romania. Probably we will need more time to clarify them what is it and how to implement the RRI dimensions in their normal classroom. Probably we will need also more time to learn them how the ENGAGE activities can be integrated into their lessons and much more time to convince them to change their way of teaching, in order to get more interest from their students.

The new version of EdX platform was installed in June. The second course refers to a small pilot lead by the UK to test the new platform. SHU managed to contact ten in-service teachers who participated in the course from 07th to 30th of July (Figure 1). The majority of teachers were very active in the forum discussion. Five participants were able to apply ENGAGE with students and complete the key tasks.

As reported by the OU partners, it was a difficult period due to summer holidays and the course finished after the end of term when most of teachers were on holidays. However, two participants replied the post course survey with positive feedback. The tutor prepared a detailed report with suggestions of improvements, such as easy access to students' enrollment, notification related to new contributions in the forum, analytics to follow participants' progress, file upload and content (video and slides) integrated to the course pages. The tutor also highlighted that participants were very engaged in the discussion and managed to share their experiences and reflection of their own practices.



About this Course

ENGAGE is an European project part of the "Science in Society" for promoting Responsible Research and Innovation (RRI).

ENGAGE provides teachers with curriculum materials to get students talk and think in socio-scientific issues that impact in their life and the planet as a whole. It also offers three online courses for teachers to enrich their practices through easy-to-use tools based on scientific inquiry pedagogies.

In order to maximise student achievement, ENGAGE online courses aims to help teachers:


1. address contemporary science issues and applications relevant to students.
2. develop beliefs, knowledge and classroom practice for 'RRI'.
3. expand their online community built around science-in-the-news and curriculum materials.

This first online course aims to discuss two ENGAGE tools: dilemma and group discussion.

Prerequisites

1. Register in engagingscience.eu
2. Open mind, interested in practical approach

Course Staff

 John Wardle - Sheffield Hallam University

John has a wide range of experience in science education, starting his career as a science teacher and progressing to his last post as head of the Centre for Science Education at Sheffield Hallam University. Throughout this time his interest and focus of work has been in the areas of the use of IT in science teaching and professional development for teachers. John was director of the Science Learning Centre from 2005-2013. He has developed a number of online programmes for science teachers and is now working as a consultant to the Engage team at Sheffield Hallam.

Course Number	uk01
Classes Start	Jul 07, 2015
Classes End	Jul 30, 2015
Estimated Effort	6 hours in total

Figure 3: The UK course UK 01 in July 2015 for ten in-service teachers

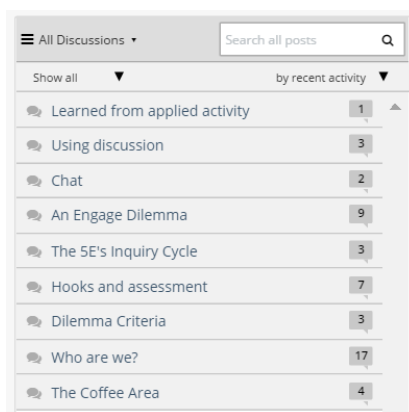


Figure 4: The discussion forum of the course UK01 in July 2015 with 40 messages among eight active participants

Comments from Teachers at the beginning of the course

“What does the fox say”

I have viewed some of the ENGAGE materials and would describe them as very INTERESTING. I want to practice skills of interpretation and discussion with my science classes. ENGAGE materials make activities that are interesting with real world relevance. We're currently doing physics in year 9 this term and I would like to try to use again the "What does the Fox Say" J.U.

Comments from Teachers at the end of the course who used ENGAGE with students

“Eating Insects”

“The students were thoroughly engaged and this had led to me thinking of potential cross curricular links with food tech / school canteen and perhaps developing a menu etc...” B.R.

“I used it as the end of term lesson for yr 7 and 8. I had to expand it as our science lessons are 2 hours long. So I also included some of the documentary from the BBC. We did the menu's for the canteen and talked about sourcing the insects. We then did the persuasive argument and did some literacy around it. As a department we discussed how the lesson could be expanded to include fieldwork, numeracy, PSHCE etc. The students were fascinated by the topic and came up with loads of ideas” V.C.

“I applied the activity some weeks ago, and I found one difficulty: some graphs were difficult to understand for some students. I think next time I would interpret myself one of the graphs to show them how data can be interpreted as a modelling strategy. The activity helped students to make the difference between opinions and facts”. J.M.

3.6. Reflections on dissemination strategies

As it has been planned at early stages of ADOPT and reported in D4.7, dissemination of activities followed a localized plan. Successful elements of dissemination strategies are provided below:

Israel: “Working on a 30 hours course to ensure the teachers get credit for their time. Using our connections – we asked to be invited to other PD programs only to present ENGAGE and even one tool (we were usually invited to have a 1/5-3 hours session). Be present at most science teachers' conferences in the country, and presenting ENGAGE in the parallel sessions.”

Spain: “Participating in face-to-face events such as science fairs for teachers and/or students in different parts of Spain: Barcelona, Madrid, Sevilla. Creating synergies with other European projects in Spain with complementary goals. Strong and frequent presence in social networks (websites of teacher associations, online teacher communities, twitter, facebook). Publishing the link to the materials in online repositories. Improving the “contact” form of the ENGAGE site in Spanish. Shortening the messages sent in our newsletter, i.e. more clear”.

Norway: “The Norwegian site has been updated with new materials on a regular basis and social media has been used to announce the updates. Links from national sites for science teachers to the Engage site have also been helpful for dissemination. For the recruitment of teachers to ADOPT workshop contacts with local schools have been important.”

Switzerland: “Presenting the Engage project to science didactics and pedagogical experts in several different meetings in Switzerland. I think that this makes it easier to go then to teachers that are working on the field. The fact that I have done myself several CPD courses and that I have been working myself as a secondary teacher here in Fribourg in the past is helpful: I know already many teachers, coordinators and experts. Having a personal contact with teachers and coordinators is important (phone calls, skype, f2f meetings).”

Lithuania: “ One day seminars were really succesful among teachers, so we plan to organize 1-2 similar seminars in the future. We succeeded to disseminate our activities with the help of local teachers associations, especially the Association of Biology Teachers of Lithuania; this organization have a very broad contact list of science teachers and we plan to ask their help for the dissemination of our activities in the future as well.”

Reflections for refinement of dissemination strategies:

Cyprus: “Teachers are interested in activities that are practical (have an inquiry-based approach) and can be implemented as part of the local curriculum. Therefore, the strategy previously used had to do with re-designing the materials during the workshops, and then providing support when the materials are implemented in the classroom. We will follow this strategy again for ADOPT 2nd year. Finally, it was easier to have a face to face meeting with the teachers before we could convince them to go online and check the materials.”

Germany: “Now we are developing more dissemination materials (project trailer, short flyer) in order to increase the number of registrations.”

France: “Dissemination strategy has already been modified (see Appendix 2-France). An extra collaborator was hired to work specifically on dissemination. An external company, specialized on educational networks and on-line resources, has been subcontracted. A massive campaign will start at beginning of October 2015.

4. Conclusions and Recommendations

The ADOPT 1st year implementation in 11 countries of the consortium has been successful mainly in terms of materials uptake and participation in face-to-face workshops: **by June 2015 more than 5200 teachers have been registered in the ENGAGE platform** and have downloaded at least one material, and **more than 350 teachers participated in the ADOPT workshops**. Outcomes of the evaluation (WP8) will provide evidence in terms of the qualitative targets of ADOPT (see section 1.1) for both materials uptake and workshops learning outcomes.

It is important to note that the vast majority of the partners reported only positive feedback from teachers in the online community for the materials as evident in the national ENGAGE web-pages. Some comments for materials refinement however are evident. It is **recommended that WP3 takes into consideration these few comments, for refinement of the materials for the 2nd year of ADOPT implementation**. WP4 will revisit the framework of workshops based on the outcomes of the evaluation.

At a country level, the experience gained by the implementation of 1st year ADOPT will be of great help for the deployment of 2nd year ADOPT. Based on the challenges confronted in the first year, **it is recommended that WP4 partners revisit their dissemination plans and implementation strategies for more successful implementation of the 2nd year**.

5. APPENDIX 1 – Workshops Framework

ADOPT Professional Development Framework (Workshops)

This Framework describes each element of our PD programme, and provides a clear objective and rationale for the strategies we have chosen. Its purpose is to enable all partners to provide a similar, high standard of input to teachers' development.

Essential and localised elements

To achieve objectives and be consistent with the DoW means that the Workshops have certain 'essential requirements' for each partner's delivery.

➤ *Essential elements:*

- Dilemma and Discussions Tools will be the focus of all workshops
- ADOPT Professional Learning Outcomes
- Workshop Session Objectives
- Participation time: minimum of 5 hours of teacher Face to Face participation

Other elements should be 'localised' and designed to meet the needs of teachers in each country.

➤ *Localised elements*

- Marketing: which benefits/outcomes are prioritised in selling the Workshop to teachers
- Session Activities: activities and exemplars used with teachers
- Session Learning Strategies/Focus: see Appendix 3 and 4
- Workshop Organisation: either 1 full day or a number of shorter sessions

Vision for expert RRI teaching

The starting point is to describe what 'practices' we want from ENGAGE teachers at the end of the project. The DoW describes 5 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

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

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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

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.

Implement practices using 'Tools'

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

It is to turn the practices into a small number of easy to use 'Tools' for teaching. Instructing teachers in the Tools then becomes the focus of our PD programme.

An example of a Tool is the '5E Learning Cycle' which makes it much easier for novice teachers to implement guided inquiry. The Tools approach is supported by the 'habits' literature: people find it easier to change if they are given one or two concrete habits to adopt, which then catalyse further changes. A sub-group of partners has developed the Tools for ENGAGE - 2 for Adopt and 4 for Adapt.

ADOPT Tools

The focus for ADOPT is helping teachers to be competent using the activities and teaching strategies in the Materials. The ADOPT Tools reflect the two distinguishing features of our Materials:

1. A lesson organised around setting up and resolving a 'Dilemma'
2. Students work on the Dilemma task in groups, through discussion

➤ Dilemma Tool

We used the name 'Dilemmas' for ADOPT Materials because tasks focus around students intriguing questions which have no obvious right answer. Dilemma lessons are constructed in 3 stages, each with a different purpose. So the Dilemma Tool makes clear what is required of teachers and students in each stage to achieve engagement and learning.

➤ Discussions Tool

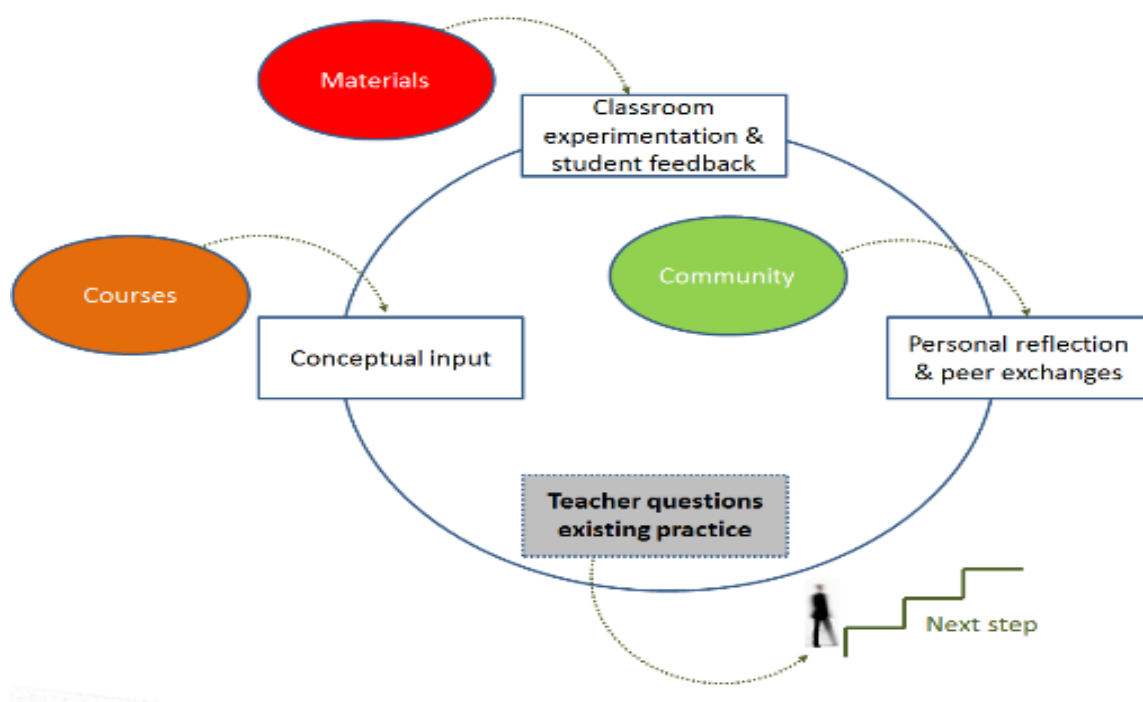
This Tool provides teachers with practical techniques to ensure students can work together productively in groups. It takes a problem-solution approach to setting up groups, preparing students to discuss, and how to support them (N.B. learning argumentation is covered in ADAPT).

ADOPT learning outcomes

Having clarified the content of our ADOPT PD programme - the Tools – we could more clearly define ‘success criteria’ for teachers who pass through the ADOPT stage (and into ADAPT). We have called these ‘professional learning outcomes’, and there is some progression from outcomes 1-3, to allow for different teacher starting points and rates of progress. 1 focuses on usage, 2 is about integration, and 3 is the ultimate goal of applying and innovating

1. Teachers understand the rationale for the Tools Dilemma lesson and Group Discussion and their implications for classroom practice.
2. Teachers use the Tools competently so that student are engaged, achieve their learning outcomes, giving teachers positive experiences which they reflect on
3. Teachers can apply the Tools to lessons beyond the Materials, or to other areas of practice.

The role of Workshops in teacher inquiry



A good PD programme also needs a ‘theory of action’ – a hypothesis for how we expect ENGAGE actions to cause these outcomes to happen. In the DoW we described teacher learning as a complex system (see diagram), where multiple conditions need to work together over a long period to create change. We want to stimulate teachers to be ‘active inquirers’- motivated to learn how to teach science using issues.

Materials start the inquiry process, giving teachers positive experiences in the classroom, and raising questions in their minds about how and why the approach works. The Workshop (and Online Courses) help to answer these questions, with practical and theoretical input on how to maximise engagement and learning.

Workshop outcomes & strategy

The main goal of ADOPT Workshop is simple: to maximise the probability that teachers will use the 2 Tools when planning and delivering a Dilemma lesson, and implement the Tools accurately. In addition, we want to encourage teachers to progress further into ENGAGE, towards ADAPT.

Our strategy has two parts: **understanding and enabling teachers**. Thus sessions for each Tool are constructed around these 5 elements:

Understanding

- Introduce the purpose of the Tool
- Break it down into 'chunks' and model each one clearly

Enabling:

- Teachers immediately practice using each chunk and receive feedback
- Explain the rationale behind the Tool, to enable flexible usage
- Teachers plan how they will implement it back in school

Dilemma tool

Introduction

The aims of this Tool are:

- 1) to help teachers understand the 3 stage lesson framework on which ADOPT materials are designed, and plan how to use it to maximise the effectiveness of the lessons
- 2) to illustrate the key features of a Dilemma, so teachers can adapt ENGAGE lessons or create their own

(1) is most important as this is the key to teachers using the Materials effectively. (2) is only really important for the sub-set of teachers who want to create their own Dilemmas, or perhaps adapt ours.

Authentic Tasks

- simulating activities students might do in real-life. The rationale is that by seeing the relevance of their knowledge and practising its use in context, students will be more likely to use scientific thinking in everyday

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life. Of course, our tasks dramatically simplify the real issues to make them accessible to students, and to minimise curriculum time.

The 3 stage lesson Framework

An ADOPT Dilemma Lesson engage students in solving a real-life problem. It sets up a Dilemma question which students then have to have to resolve by applying previously learned scientific content together with inquiry (RRI) skills to solve the problem.

A Dilemma lesson is in 3 parts and because these correspond with 3 stages in the 5E's inquiry cycle, it is instructive to use these labels. In the 5E's, the stage Engage, Extend, Evaluation have specific outcomes. By writing these in the form of questions, these questions serve clarify the challenge for teachers in making Dilemma lessons work most effectively:

Engage Stage

- Did you capture students' attention with the context?
- Did you activate students' relevant knowledge?
- Did you make the learning objectives meaningful, by provoking curiosity in the Dilemma?

Extend Stage

- Did all students retrieve relevant knowledge and use it to solve the problem?
- Did all students retrieve relevant inquiry (RRI) skills and use them to solve the problem?
- Did all students give an overall decision, evaluation, or solution, with justification?

Evaluation Stage

- Did students/you get feedback on their knowledge/skill, to improve their performance?
- Did students reflect on what they learned from the lesson and how?

Using the 3 stage lesson Framework

As the questions for each Stage imply, the success of each stage depends on what the teacher does, as much as what is in the Materials. For each stage/question there are various strategies teachers can use, and some are listed here:

Engage strategies

- Find out about the new story to become enthusiastic yourself

- Make the context more dramatic using props or demonstrations
- Ask questions to relate the Dilemma to students' experience
- Get students to compare their reactions to the question with other students

Extend strategies

- Listen in to group discussions and ask questions to check understanding
- Remove scaffolding in student sheet for more advanced students
- Support students in interpreting sources of evidence
- Support students in formulating a justified response to the Dilemma

Evaluation Stage

- Use formative assessment techniques to assess students' understanding
- Get students to self- or peer- assess the outputs
- Ask students what was easy or difficult in the task, and how they solved the problem

Key Features of a Dilemma

Teachers can create their own Dilemma lessons, by using the same criteria to select a suitable Dilemma as the ENGAGE team uses, and crafting a task around it. There are 5 criteria which make a Productive dilemma, and these can be applied to a shortlist of possible news stories, to select one(s) which will work as a Dilemma lesson.

Criteria	The Dilemma ...
1. It's authentic	... should be a real question, choice, or action that students (or somebody from their environment such as a friend, family member, etc), either now or in the future, might consider in response to news in the media about emerging science or technology
2. It's controversial	... should not be an obvious choice or action for students, in order to merit thought and discussion. Some dilemmas are personal choices, and others involve decision making on a community or societal level.
3. It's	...is likely to be interesting to most students, either because we have tested this, or because it has a 'hook'. Hooks could be a story with strong human interest, or what we know

engaging	students like about science, e.g. popular topics with boys/girls, concerns about the future, lifestyle, disasters, celebrities.
4. It's covered	... should require the use of science in its resolution, which applies knowledge that is part of the national curriculum (or equivalent), at an appropriate age-level
6. It's enquiry/RRI	<p>... should apply an enquiry process (RRI knowledge/skill)</p> <p>e.g. Technology, Big science, Values thinking, Scientific Media</p> <p>Define problems, Evaluate solutions, Construct arguments, Critique arguments , Interrogate media, Communicate ideas</p>

More -in-depth information and notes

Specification of dilemmas

Our specification includes answers to what is a dilemma, why to include dilemmas in science education and finally an example of how this can be made.

Dilemma is a situation in which a difficult choice has to be made between two or more alternatives, especially equally undesirable ones.

Science research faces many ethical dilemmas. Atlanta Clinical & Translational Science Institute's (ACTSI) presents case scenarios involving responsible conduct in research. The cases include issues on:

Allocating Credit, Animal Use, Authorship, Confidentiality, Conflict of Interest, Data Interpretation and Management, Data Representation, Drug Trials, Informed Consent, Intellectual Property, Mentoring, Misconduct, Participant Recruitment and Protocol Deviation

(http://www.actsi.org/areas/ethics_reg/ethics/index.html)

These issues addresses scientists, and scientists' responsibility and integrity, however some of them have strong link to societal morals, values, priorities and more.

In the ENGAGE project we may involve some aspects of these dilemmas, however we target also dilemmas that each and every citizen may face and not only scientists. The ability to negotiate and resolve socioscientific issues has been posited as integral components of scientific literacy (Sadler & Zeidler , 2002) .

The main reason is to improve individual decision-makers. Sadler & Zeidler's research (2002) revealed that moral and cultural considerations were significant influences on decision-making.

For instance, one of the ENGAGE materials EBOLA presents a controversial scenario: scientists are fast tracking a vaccine to fight Ebola. The polemic dilemma is: **will students volunteer to test it?** They gather information from different sources, weigh up benefits and drawbacks and apply what they know about genes to decide if it is a risk worth taking.

We target for engaging students moral, ethical and societal reasoning based on analysing the benefits, risks and possible sequences. We are also interested in supporting students' ability to use the scientific knowledge and principles that they learn in science lesson in their decision-making processes. This is especially important as research indicate that many students use emotion and intuition in the process.

Sadler & Zeidler (2002) mapped a series of factors that are involved in socio-scientific decision-making. These factors included personal experiences, family biases, background knowledge, and the impact of popular culture.

Group discussions Tool

Introduction

The purpose of this discussion tool is to help teachers make group discussion work, especially group discussions that are linked to RRI issues by:

- Using 'best practice guidelines' on how to i) set tasks, ii) form groups, iii) prepare groups, iv) support discussion,
- Reflecting on challenges the teachers have experienced, and considering solutions,
- Understanding the challenges of setting up and evaluating discussions linked to RRI issues, or issues with moral and ethical concerns.

What are group discussions and why do we use them in ENGAGE?

ENGAGE ADOPT Materials aim amongst other to put students in groups of 3-4 to work on a collective task, without direct supervision by the teacher. The tasks are designed to be collaborative i.e. they ask students to work together and collectively as a group come to a decision or solve a problem. Furthermore, the tasks are based on authentic issues, i.e. ill-structured problems with multiple solutions rather than right/wrong. Some of these problems can be approached not only by making use of scientific knowledge, but also by basing decisions on ethical or moral concerns. Therefore, so some advantage of working with others. There are

many reasons we believe that it important for teachers to use student-student interaction for teaching socio-scientific issues or RRI:

- 1) It practises how students will engage with controversial issues beyond school, through opinion sharing, discussion and negotiation
- 2) It can be easier to get students to learn actively, when they have more control and choice
- 3) There is time for all students to contribute to discussion, so everyone can try out and share new ideas in an environment
- 4) Students can learn from each other (to gain confidence and competence), using another's ideas to help build their own, evaluating ideas, and comparing solutions
- 5) Shy or less articulate students may find it less threatening than speaking out in class, and easier to talk without the barrier of teacher-approved language
- 6) Students enjoy it!

The educational psychology theories suggests many possible benefits for group discussions:

It is a constructivist process of mutual building knowledge, it allows the development of learning communities, helps the community develop and share norms, allows peers review and peers assessment, and allows students to learn at their Zone of Proximal Development.

Reflecting on challenges and solutions

Since most teachers have already used group discussions and have probably found it challenging, it is good to build on their experience - and start with a diagnostic or 'trouble-shooting' approach. Once teachers have identified the challenges they have experienced and its most likely cause, they will be more likely make use of the solutions. Samples are shown in the table:

If your challenge is	The cause might be ...	See 'best practice in ...'
Students go off task after a while	Lack of structure, or accountability for an output was	Setting Tasks

Low level of discussion	No differences of opinion to stimulate proper argument	Forming Groups
A few students 'sabotage' the group	Lack of clear ground rules about acceptable behaviour	Preparing Groups
Students not listening to each other	They need to develop listening skills	Preparing Groups
Students stop talking when you drop in	Students expect teacher to supply answers	Supporting Groups

Best practice in Setting tasks

1) Check students have sufficient knowledge

Discussion is more productive if students are confident with the expected prior knowledge that they will need to use in their discussion. In ENGAGE materials, there is a starter to recap science concepts, before their implications are discussed. Our tasks also make it clear what are facts (not to be questioned) and what are evidence/opinion (can be argued about).

2) Keep tasks short and structured

Less experienced students are likely to wander off topic, and it is best to start with short focussed tasks. To encourage high level discussion, ENGAGE tasks have a 'discussion agenda', listing the points to be discussed, to ensure students know what to talk about, and know when they are on/off topic. On the other hand, over-structuring the task can stop students from thinking for themselves.

3) Make groups accountable for an output

The best way to ensure students learn without supervision is to define a clear output for the task e.g. to solve a problem or come to a group decision. This should be reported back in some form, so that students know they have responsibility to achieve the output.

4) Create conflict

Students will be more likely to engage in arguing if they see a reason to do so - conflict. ENGAGE tasks create conflict by having sources which disagree, or by putting students into roles which have differences of opinion. Research indicates that conflict and the need to build on each other's views improves quality of discussion, and reevaluation of students' positions.

Best practice in ... forming groups

1) Use groups of 3 to 4 students

Sometimes students discuss in pairs, but this can lead to students seeing it as situation of right/wrong whereas with 4 students they will more likely see a range of opinions to be evaluated. Although a group can be up to 6, smaller groups help to avoid having students sitting on the sidelines while others dominate.

2) Try friendship groups

Group dynamics play a big part in a discussion. Students won't discuss until they feel confident with their peers, and that it is OK to argue/conflict opinions. So stick with the same groups for a while. Friendship groups (which are generally single-sex) are worth trying, as they have been found to function more effectively than groupings that the teacher has decided.

2) Give students discussion roles

Allocating roles can lead to more effective discussion when the roles support group interaction (and avoid students working independently). Leadership is vital to keep the discussion focused and to uphold the ground rules.

- Leader: reads the assignment, restates points, mediates conflict, and manages time
- Listener - asks probing questions, or asks for better explanations, or recalls areas left out
- Reporter - get group to answer his questions in order to report back
- Encourager: gives team members feedback, is responsible for ensuring that all group members are heard.
- Reflector: who keeps track of group process and makes comments about focus, listening skills, participation.

4) Organize the environment

Some laboratories present obstacles for small group discussion. Ideally students should sit in small circles, close together. Everyone needs to be facing each other if they are to talk to one another.

Best practice in ... preparing groups

Giving students the skills they need is essential for high quality discussion. We need to give teachers strategies to help this.

1) Establish ground rules upfront

Students need to know the behaviour expected of them in groups. Too often these are left implicit. Ground rules for discussion can be identified as a class, but an effective way to get students to follow them is to get them to write the list for themselves and to display it within the group. Then encourage students to refer to these whenever an issue arises. Since the whole purpose of discussion is to see things from perspectives different from our own, the most fundamental rule is listening to others. A good *set of rules* might include:

- everyone's opinion is listened to and respected
- everyone takes responsibility for good behaviour
- Silence is O.K. Think before speaking.
- Don't interruptions or ridicule are discouraged
- If you don't understand, ask for clarification
- Everyone has an equal right to be heard

2) Use practice exercises to develop discussion skills

Try short exercises to build specific skills, before students start the discussion. For instance, there are many games to promote better listening e.g:

Being heard: Pair up participants. One person talks about a hobby while the other person is instructed to ignore them. Discuss the frustration that can come with not feeling heard, and review strategies a good listener should practice.

Listening accurately: One student reads a short story, and the others have to paraphrase. This activity shows how we prioritize certain information over others.

Listening actively: One talks about a location they'd like to visit, but gives only hints as to the specific place. The listener has to pick up on these subtleties and at the end, recommend a suitable place. The original speaker will confirm or deny whether this and the two discuss ways people can pick up on the appropriate cues to play a more vital role in discussions.

3) Provide scaffolds and scripts to develop discussion skills

One approach is to focus task on particular skills, and provide students with scaffolds to structure their initial practice attempts, or scripted language prompts to guide them. Here is a 3 part scaffold for structuring a contribution (it is an ADAPT Tool which goes into the full claim/explanation/reasoning framework):

1. Link

I'd like to comment on [Name's] point about Or I'd like to make a new point

2. Express

I think/believe , Or my opinion is that ...

3. Support

My reasons are ... I think/believe that because ...

Here is a set of scripted language prompts for the skill of 'disagreeing with others':

<i>Say This...</i>	<i>Instead of This...</i>
I don't think I agree. Could you explain.	That doesn't make sense at all.
I disagree because ' I see it differently because	Wow! Is that ever dumb.
I think we should check our notes and the original assignment.	That is not what the teacher asked us to do.
It might be better to Have you considered	You are dead wrong.
Does everyone agree?	Let's vote on it.
I understand how you feel, but I think you might consider also	That really offends me!

Best practice in ... supporting discussion

1) Listen in, then support or challenge

Drop in on groups for short periods. As they may stop talking when a teacher appears, make sure they know you're just there to listen. When they continue talking in your presence, decide whether your input will be a) give them more support in the mechanics of discussion, or b) challenge them to discuss on a higher level.

2) Deal with emerging problems

Noise can be a problem, and needs to be kept to a productive level. Don't allow one group to become too noisy or they will attract interest from other groups, who will lose their identity. Some student' behaviours may fall into one of these categories which will require action. Here are some suggestions:

- Silent/shy students: invite them directly, ban interruptions, and congratulate small contributions
- Clowns/distractors: confront and explain problem, give guidance and reward better behaviour, separate from anyone who encourages this behaviour
- Apathetic/bored: Place with friends, give them a specific role, and encourage contribution
- Dominant/over-talkative: explain problem (but praise contribution) allocate a recording or leadership role, place with similar students
- Duellists/aggressors: identify reasons, suggest preferred behaviour and advise on self-control and resolving conflict, separate known duellists

3) Move between small group and whole group

Show students their discussions are valued by getting contributions from individual groups and sharing these with the whole group. Draw out similarities and differences, and get individual students to give reasons for the range of views.

4) Anticipate sensitive issues

If there are students who are vulnerable to the discussion topic, either warn them in advance, make sure they are in an understanding group, or let them sit out.

Discussion Formats

In traditional classroom discussions, teachers ask the questions—which often have a single right answer, and students are told whether or not their responses are correct. The questions asked tend to focus on factual knowledge or experience (e.g., “What did we observe?” or “What did we do?”). These discussions are typically referred to as “IRE dialogues”: The teacher initiates a question, a student responds, and the teacher immediately evaluates whether the answer is correct or incorrect. This type of discussion is useful in some cases, as it provides a quick, whole-class review before moving on to new activities.

However, research has shown that IRE questions often do not allow the time for all students to think and respond, and discussions involving socio-scientific issues, ethical aspects and decision-making is an interplay of meanings and ideas mainly from students and affords a different type of questioning.

More specifically, students need opportunities to express their own ideas (even if they are not always correct or well-structured), listen to their peers ideas, evaluate and critique ideas, and revise and integrate them as well. Classroom talk should center on engagement and thoughtfulness. Students should ask questions that arise from their own interests or confusion—and they should ask questions to each other as well as to the teacher. Teachers should pose questions that push students to think more deeply about what they have observed, experienced, or read.

To this end, we present three types of discussions that promote students' thinking: brainstorming, synthesizing, and sense making discussions. Figure 1 displays the three types of discussions and some suggested prompts for each. In practice, classroom discussions are often not limited to just one type but include elements of more than one.

Figure 1: Types of discussions.

Suggested prompts	Characteristics	Type of discussion
What do you know about...? What do you or others think about when they hear the word...? Who has a different idea/response/way of thinking about this? What else is on your group's list?	Sharing ideas without evaluating their validity or value.	Brainstorming
How does... help us think about other times when...? How can we put these four ideas together into one process that we might call a cycle? What happens first, second...? What do we know about... so far? Yesterday we talked about...	Putting ideas together. Generalizing from specific activities to a broader conclusion. Making connections to personal experiences, previous lessons, or knowledge constructed in other units, lessons, or subject areas.	Synthesizing

<p>how does today's activity help us think about it differently?</p> <p>How does what we have just done connect with...?</p>		
<p>How does x compare with y?</p> <p>How do you know x? What evidence supports that idea?</p> <p>What does it mean to say...?</p> <p>Why does our old model not work to explain this new phenomenon?</p> <p>How could we figure this out?</p> <p>What new questions do you have?</p> <p>Why do you think we are seeing something so different from what we predicted?</p>	<p>Figuring things out or making sense of activities. Going deeper, beyond surface answers. May involve challenge, debate, or argument in which students justify their ideas. May involve revision of previous ideas as students learn new information that calls into question the limitations of what they "knew" previously.</p>	<p>Sensemaking (Pressing for understanding)</p>

What research has to say about the importance of using student' discussions and collaborative activities in classrooms

The research literature offers limited support for group discussions as a teaching approach, according to one systematic review (Bennett et al, 2004). What we need is to understand the important factors in how discussions can develop understanding of socio-scientific issues. We have just a little evidence e.g.

- The importance of explicit instruction, if students are to develop their skills e.g. in argumentation
- The importance of conflict - the need for a diversity of views and/or understanding within a group, or in the external stimulus - for high level discussion, and understanding of evidence.

- The importance of interaction - structuring tasks so students use others' ideas to construct their own, or complete the task - this improves discussion and higher level thinking

According to Hogan et al. (1999), in one of their studies, the more the peers talked in the groups about conceptual issues, the higher the reasoning levels they achieved, which suggests that the ability to elaborate each other's ideas was associated with more sophisticated reasoning. This finding is similar to the work by Mercer and colleagues (1999) and Resnick and colleagues (2010), whose studies in discourse/discussion suggest that when students explicitly discuss each other's ideas then the reasoning gains are higher. Recent studies explored the impact of students' academic performance and their findings suggest high ability groups collaborate more, and focus on making sense of their data (Ryu & Sandoval, 2008). Additionally, the main differences between high and low performing groups when working on a scientific issue were the number of ideas introduced; how other students responded to these ideas; how often the proposed ideas were challenged; the criteria used to distinguish between ideas, and how group members used the available data (Evagorou & Osborne, 2013; Sampson & Clark, 2009). Other researchers (Chin & Osborne, 2010) have found that successful groups were characterized by the use of questions which focused on key inquiry ideas and explicit reference to the structure of the topic under discussion.

Therefore our 'best practice' guidelines are based more on accumulated expertise in designing and running effective discussions. These aim at supporting our students in asking each other questions, negotiate their understanding of what they are discussing, and talk about the structure of the final product of the group.

Types of discussion as they occur in the classroom

Mercer and his colleagues (Mercer, Wegerif, Dawes, 1999) observed a number of classes when students were working in pairs and found that there were three main types of talk/discussion that occur in groups, namely:

- (a) Exploratory talk – partners engaged in critical but constructive discussions, it is a type of talk that generates alternative claims and supports the reasoned competition between them, a type of talk similar to argumentation;
- (b) Disputational talk – competitive talk and individualized decision making; and
- (c) Cumulative talk – students shared and built information in an uncritical way.

The two latter types of talk were the most often in the classrooms, while exploratory talk, which is the highest level of talk and lead to cognitive gains (Wegerif, Mercer & Dawes, 1998) was rare. Our aim as educators is to achieve exploratory talk during group discussions in our classes.

Table 1 below presents the different types of talk that take place in the classroom during discussions, along with a description of each category. The second part of the table presents actions/activities that take place during the discussions and can support students when they engage in the high level discussion form of exploratory talk.

Table 1. Types of discussion and actions during discussion

Discussion Category	Explanation
Exploratory talk/negotiating a shared understanding	The students in the group engage critically but constructively with each other's ideas or when the ideas offered by one student were discussed. This category can involve question asking, but it can also involve productive, argumentative interactions in which individuals are working to resolve disputes, without necessarily asking questions.
Dispute talk	Defined by an explicit challenge of a claim put forth by another participant (i.e. disagree, not true)
Cumulative talk	The speakers agree with each other but: without debate, and they share and build information in an uncritical way.
Asking questions	They ask each other questions about the data, or any other question that is relevant to what they are discussing.
Questioning data	They engage in questioning the validity or trustworthiness of the data.
Explaining data	When the students try to explain the data to each other.
Reading data	They read the available data.
Discussing structure	The students in their pairs are discussing the structure of their final submission/ argument.
Using analogies	Students use analogies to understand their data, or to explain the data to another students.

Other than the aforementioned types of talk that take place in groups, there are a number of other activities that the teacher can organize in order to provide a structure for group discussions:

Brainstorming discussions

A brainstorming discussion takes place usually at the beginning of the lesson. Its purpose is to allow students to share their experiences, and elicits their thinking.

Synthesizing discussions

A synthesizing discussion is a discussion in which students evaluate their ideas, suggestions and the evidence provided. A synthesizing discussion involves putting ideas together, or assembling multiple activities into a coherent whole. It also includes generalizing from specific activities to a broader conclusion. A synthesizing discussion helps students organize their knowledge and integrate their ideas about the topic discussed. It also helps students realize how their individual thinking is similar to or different from their peers' thinking about the same topic, and how ideas raised by others can be synthesized into a meaningful picture of the discussed dilemma. The inclusion of sense-making prompts by the teacher is necessary to remind students of their conclusions from previous activities and to support them in presenting their thinking to peers. The overall purpose of this discussion is to integrate ideas.

Consensus discussion

Usually in our activities we do not intend to reach a consensus but allow a variety of well-justified views. However, often students working in small groups are required to reach a consensus regarding various things: the validity of the data gathered; the way to represent the data; the meaning of the data. In cases a consensus is needed the teacher may ask: "Does everybody agree? Is everybody happy with that?" If one or more students disagree, the teacher may ask the class: "What should we do in order to resolve this?" Sometimes it is wise to postpone the decision until they had more evidence to favor one decision.

Reaching a consensus is one example of the necessity of discussions. The consensus discussion serves both to promote students' learning and to construct a community of learners; it also models the discussions among practicing scientists.

Sense-making discussions

A sense-making discussion usually follows students' reading, investigation, experiment, demonstration, or simulation. Its purpose is to get students thinking more deeply about their experiences and their answers. Weick (1995) points out that sense-making comprises what people do in socially complex situations, when confronted by incomplete evidence and competing interpretations. The degree of uncertainty around learning will of course vary depending on the learner's ability, the learning objective, the complexity of the material, and to a degree, the discipline (e.g. there are harder "truths" in the sciences than in the humanities). However, the point is that when there is uncertainty, what else is there to do but through discourse, construct a narrative to fill in the gaps? "The point we want to make here is that sense-making is

about plausibility, coherence and reasonableness. Sense-making is about accounts that are socially acceptable and credible." ([5], p.61).

In reality - most discussions are mixed discussions.

Group preparation

Guiding discussions, in contrast to leading IRE dialogues, presents some challenges. Both the teacher and the students need to acknowledge the value of learning from peers. In such a learning environment, authority is shifted from the teacher to the students, and knowledge is built gradually by the whole class, instead of by the teacher simply providing facts.

Developing norms of discussions—or accepted and polite ways in which the class discourse should be handled—is also a challenge. Norms should be developed for active participation (i.e., presenting, commenting, constructively critiquing, and persuading) as well as for passive participation (i.e., listening and respecting various opinions). The teacher should use strategies such as “wait-time” to give all students time to think and answer, ask students to support statements with evidence; and provide scaffolding when necessary. The teacher should remove himself or herself from the conversation and encourage students to talk to one another make sense of something together. Discussions help students learn science content but moreover to develop their communication, analytic and argumentation skills. Discussions are a way to acclimate students to the culture of science, as debating and revising ideas is a major practice of any true inquiry process.

Gender and cultural differences

Sometimes students assign each other roles in groups based on gender socialization, relying on communication styles with which they are most comfortable in social settings. Groups work together best when group members experiment with a variety of roles in groups, even those with which they don't have as much experience.

Sometimes differences in cultural backgrounds make group communication difficult. You may have grown up in a community in which communication styles are significantly different than those of other students. Typical cultural differences in patterns of communication include greater or less degrees of bluntness, greater or less assertiveness in speech, and a preference for either direct conversation or for roundabout and indirect conversation. Groups work together best when members exercise a sensitivity to these differences, value their uniqueness, and remain open to talking to each other despite their differences.

Group work can become frustrating if a group member puts all his or her energy into expressing his or her view and no energy at all into listening to others and reaching understanding as a group. But group work misfires also when a group member puts no energy at all into the group effort, quickly agreeing with the first

statement offered and deciding that the conversation is over. What leads to an excellent discussion? All members agree to an extended conversation in which all share their views. When they move gradually but steadily toward the integration and synthesis of views, creative, high-energy, and effective learning occurs among all members of the group.

Group discussion using technology

Discussion Foru ; Dialogue evidence-based map; Web-conference

You can find some more information about norms and “netiquette” in the following links:

<http://teaching.colostate.edu/tips/tip.cfm?tipid=128>

<https://www.youtube.com/watch?v=1dumMk6da-U>

<http://blogs.onlineeducation.touro.edu/15-rules-netiquette-online-discussion-boards/>

Suggested activities to do with teachers

Watch a video of a discussion and identify the type of discussion and the leading prompts reflect on a discussion that recently took place in your class - what was the topic? what did you like about it? what didn't you like?


Discussion with teachers: what challenges do science teachers face when facilitating a discussion involving socio-scientific and RRI issues?







A shared forum or shared synchronous lesson for teachers - norms of active and passive participation (talking and listening) in different countries.

For F2F moderators: if you engage the teachers as students in a task from existing materials in a group discussion and then ask for a self-evaluation based on the check list below

Test your self - Are You an Effective Participant in Group Discussion?

If you are wondering about your skills in group discussion, think back about a recent class discussion. Then look at the list that follows. If you can say that you regularly achieved the outcomes on this list, you have solid group communication skills. If you occasionally or rarely achieve these outcomes, review strategies for success listed above, and try implementing some of them in future class discussions.

	I incorporated prior knowledge into group discussion.
---	---

	I asked questions of group members in an open-minded way.
	I built on comments of other group members to enhance discussion.
	I volunteered ideas in a constructive manner.
	I helped the group to summarize its progress.
	I identified missing information in the group answer.
	I built on the ideas of others.

Session Learning Strategies

	Teaching and learning approach	Description
1	Lecture/talk	Expert-led input, perhaps with practical demonstrations, followed by questions and answers.
2	Workshop	Expert led input and activities for individuals and/or groups, followed by discussion. This could include practical work.
3	Curriculum implementation	Introduction to new teaching materials or a new approach, followed by opportunity to try it out and report back.
4	Curriculum development/adaptation	Work as a group to collaboratively develop a new approach to a topic, followed by opportunity to try it out and report back.
5	Supported action research	Identification of a specific problem/issue in current practice, collect data in own context to clarify, design new approach and evaluate.
6	Debate	Structured debate on an issue concerning science teaching and learning, or about a controversial issue that might be used in teaching
7	Role play	Experience of taking part in role-play activities, to develop skills in using role play as a teaching method

8	Modelling practice	Teaching/observing/discussing an exemplary' lesson.
9	Case discussion	Group discussion of example(s) of an aspect of practice (e.g. sample of pupils' work, classroom video, new teaching materials). Focus could be tutor selected, or chosen by discussion at first meeting.
10	Study group	Group discussion of a topic or issue of mutual interest, with tutor support.
11	Attachment	For example, to a scientific research group, or a local industry, to gain understanding of an aspect of science knowledge or process.
13	Coaching/mentoring	An experienced tutor working with one or more teachers on an aspect of their teaching which they have identified.
14	Learning by experience	Teachers do a task of the kind they ask their pupils to do (e.g. a Sc1 investigation) to get a better 'feel' for what this is like, followed by group discussion with a tutor.

Session Focus

	Focus of CPD episode	Purpose	Examples
1	Teaching and learning approaches	To develop knowledge and understanding of a general teaching and/or learning approach or issue, and to develop practitioners' skills in implementing this in their own situation.	Formative/diagnostic assessment; (assessment for learning) Effective use of Practical Work Using fieldwork [Using ICT to enhance science learning – USE the ICT category 8 below] Using informal science learning opportunities (museums, hands-on centres, etc.) Developing awareness of science-related industry Classroom talk Handling controversial socio-scientific issues in the classroom

2	How to teach a specific science idea, topic or skill	To develop knowledge and understanding of issues and ideas concerning the teaching and learning of a specific science idea, topic or skill.	Teaching forces at KS3 and 4 Teaching photosynthesis Teaching about matter at KS2 ... etc. Teaching about a specific aspect of the nature of science
3	Curriculum knowledge and skills	To develop knowledge and understanding of the structure of science course provision and its presentation within the whole curriculum	Introduction to new courses/specifications Introduction/update on methods of assessment (e.g. coursework, moderation, etc.) Curriculum development and evaluation (i.e. generic training in how to develop and evaluate a teaching programme) Developing cross-curricular links Developing cross-phase links
4	Scientific knowledge, and knowledge about science	To enhance understanding of science ideas and/or practices.	Lecture or workshop on an established science topic New/current developments in science Insights into the practice of science
5	General educational knowledge	To develop understanding of issues which apply to many curriculum subjects, from the perspective of a science teacher.	Theories of concept learning Safety The legal framework Behaviour management
6	Supporting the CPD of others	To develop knowledge, understanding and expertise in working with others (teachers, trainees, technicians) to develop their professional capability.	Mentoring an teacher training student Training the trainers (courses for those involved in CPD, including scientists and industrialists)

6. APPENDIX 2- National Reports for ADOPT implementation

United Kingdom

Contributors: Tony Sherborne (SHU), Andy Bullough (SHU), Alexandra Okada (OU)

a) Materials usage

- **Number of teachers who have used the materials by end of June 2015:** More like 3,600 (it's 3700 now)
- **Most successful materials?** Please provide a list with the 5 ADOPT materials which have been most popular *in your country* (indicators: # of downloads and # of comments)
 1. Ebola 1358
 2.Ban Cola 808
 3.Attack of the Giant viruses 672
 4. Car Wards 662
 5.Three parents 644
- **Comments by users for materials refinement/revisit:** *Have there been any negative comments on some materials or proposals for materials refinement/change? If yes please explain*

No.

Interestingly many teachers are using the materials for 14-16 rather than 11-14, perhaps because it is quite challenging to use the decision making (RRI) skills.

Lots of positive comments you might want to summarize one:

Take the Test: This resource engaged a class of Year 8 boys – it was well presented, easy to navigate around and some of the slides were useful as worksheets. Setting the science in context helped them to understand the importance of pedigree diagrams and has given them an excellent platform for GCSE Science when they study this for their exams. The issues/dilemmas of taking a test, the ignorance of some and possible prejudice of others gave the series of lessons an extra dimension for the boys to hook their knowledge and understanding of genetic inheritance onto.

b) Workshops attendance

- **Please review data and complete missing info**

	# of participants	Date	Pilot or not?	Evaluation
UK	20 teachers	9.1.15	short intro and workshop (1 hour) to launch in UK at Association of Science Education Conference (Reading) to	

		7.5.15 8.6.15	20+ teachers introducing Ebola materials (no evaluation) 2 short after school pilot workshops each with 5 teachers who were given access to materials to test Dilemma and Discussion tools and gain evaluation feedback on materials. Eckington School Derbyshire Chapel En Le Frith School Derbyshire	Resulted in a focus on discussion tool for future F2F UK CPD workshops
UK	11 teachers	30.6.15	5 hour F2F CPD Adopt workshop at Manchester Met University. Key aspects Dilemma used to investigate resource materials : Big Bag Ban, Text Neck and GM. An interactive session lead by Joelle on discussion. Lots of planning opportunity for teachers.	evaluation forms completed and uploaded
UK	4 teachers	1.7.15	5 hour F2F CPD Adopt workshop at Bradford University. Key aspects Dilemma used to investigate resource materials : Big Bag Ban, Text Neck and GM. An interactive session lead by Joelle on discussion. Lots of planning opportunity for teachers.	evaluation forms completed yet to be uploaded

- **Main outcome of the workshop (s)** - Please provide a couple of sentences on the main outcome of the workshop (s), how successful has it (have they) been and in which respect.

The workshops provided opportunity for teachers to practice dilemma scenarios and also investigate group discussion skills within a supportive environment. As an integral part of the sessions teachers planned out how they would use and implement Engage materials back in their own classrooms and encourage wider dissemination.

c) Online course participation

The adopt phase had a total of 2 online courses tested with members of the consortium, pre-service and in-service teachers.

The first course refers to the ENGAGE Pre-Pilot, which was organized during 6th to 30th of April. Participants who registered in the course were ten members of the ENGAGE consortium and ten pre-service teachers from Romania (VUT). Various technical problems were listed: Error 500 EdX Platform, teachers could not upload images, problems with connection, difficulties to access the course.

The new version of EdX platform was installed in June. The second course refers to a small pilot lead by the UK to test the new platform. SHU managed to contact ten in-service teachers who participated in the course from 07th to 30th of July (Figure 1). The majority of teachers were very active in the forum discussion. Five participants were able to apply ENGAGE with students and complete the key tasks.

It was a difficult period due to summer holidays and the course finished after the end of term when most of teachers were on holidays. However, two participants replied the post course survey with positive feedback. The tutor prepared a detailed report with suggestions of improvements, such as easy access to students' enrollment, notification related to new contributions in the forum, analytics to follow participants' progress, file upload and content (video and slides) integrated to the course pages. The tutor also highlighted that participants were very engaged in the discussion and managed to share their experiences and reflection of their own practices.

About this Course




ENGAGE is an European project part of the "Science in Society" for promoting Responsible Research and Innovation (RRI).

ENGAGE provides teachers with curriculum materials to get students talk and think in socio-scientific issues that impact in their life and the planet as a whole. It also offers three online courses for teachers to enrich their practices through easy-to-use tools based on scientific inquiry pedagogies.

In order to maximise student achievement, ENGAGE online courses aims to help teachers:

1. address contemporary science issues and applications relevant to students.
2. develop beliefs, knowledge and classroom practice for "RRI".
3. expand their online community built around science-in-the-news and curriculum materials.

This first online course aims to discuss two ENGAGE tools: dilemma and group discussion.






Course Number	uk01
Classes Start	Jul 07, 2015
Classes End	Jul 30, 2015
Estimated Effort	6 hours in total

Prerequisites

1. Register in engagingscience.eu
2. Open mind, interested in practical approach

Course Staff



John Wardle - Sheffield Hallam University

John has a wide range of experience in science education, starting his career as a science teacher and progressing to his last post as head of the Centre for Science Education at Sheffield Hallam University. Throughout this time his interest and focus of work has been in the areas of the use of IT in science teaching and professional development for teachers. John was director of the Science Learning Centre from 2005-2013. He has developed a number of online programmes for science teachers and is now working as a consultant to the Engage team at Sheffield Hallam.

Figure 1 - The UK course UK 01 in July 2015 for ten in-service teachers

All Discussions		Search all posts
Show all	by recent activity	
Learned from applied activity	1	
Using discussion	3	
Chat	2	
An Engage Dilemma	9	
The 5E's Inquiry Cycle	3	
Hooks and assessment	7	
Dilemma Criteria	3	
Who are we?	17	
The Coffee Area	4	

Figure 2 – The discussion forum of the course UK01 in July 2015 with 40 messages among eight active participants

Comments from Teachers at the beginning of the course

"What does the fox say"

I have viewed some of the ENGAGE materials and would describe them as very INTERESTING. I want to practice skills of interpretation and discussion with my science classes. ENGAGE materials make activities that are interesting with real world relevance. We're currently doing physics in year 9 this term and I would like to try to use again the "What does the Fox Say" J.U.

Comments from Teachers at the end of the course who used ENGAGE with students

“Eating Insects”

“The students were thoroughly engaged and this had led to me thinking of potential cross curricular links with food tech / school canteen and perhaps developing a menu etc...” B.R.

“I used it as the end of term lesson for yr 7 and 8. I had to expand it as our science lessons are 2 hours long. So I also included some of the documentary from the BBC. We did the menu's for the canteen and talked about sourcing the insects. We then did the persuasive argument and did some literacy around it. As a department we discussed how the lesson could be expanded to include fieldwork, numeracy, PSHCE etc. The students were fascinated by the topic and came up with loads of ideas” V.C.

“I applied the activity some weeks ago, and I found one difficulty: some graphs were difficult to understand for some students. I think next time I would interpret myself one of the graphs to show them how data can be interpreted as a modelling strategy. The activity helped students to make the difference between opinions and facts”. J.M.

GREECE

Contributor: Foteini Chaimala

a) Materials usage

- **Number of teachers** who have used the materials by end of June 2015: 82
- **Most successful materials?** Please provide a list with the 5 ADOPT materials which have been most popular *in your country* (indicators: # of downloads and # of comments): Ebola; Eat insects; Solar roadways
- **Comments by users for materials refinement/revisit:** *Have there been any negative comments on some materials or proposals for materials refinement/change? If yes please explain* No. Positive reviews on Ebola, Ban Cola and Eat insects

b) Workshop attendance

16/05/2015 28 participants

Both tools were presented

Main outcomes (2 sentences on how successful they have been and on which respect)

Teachers were really engaged in both tools and provided positive feedback on the evaluation.

c) Online course

- **When it is planned to take place?** November-December 2015
- **Number of teachers?** The registration is still open and we are not sure on how many will register. Hopefully not less than 20 teachers
- Do you plan to combine it with ADAPT online course? Yes
- **Main challenges of the online course:** Please provide one/two sentences on the main challenge (s) for implementation (if any) and how do you plan to confront it

Teachers in Greece are not used to online courses, and they prefer face to face interactions. Therefore we plan to have a blended approach at first.

d) Way forward

Which have been the successful elements of your strategy to engage teachers? Which have been the elements that you would refine for ADOPT 2nd year?

Massive dissemination via teachers association, media and pedagogical institute

GERMANY

Contributor: Sonia Hetzner (FAU)

a) Materials usage

- **Number of teachers who have used the materials by end of June 2015:**

Until the end of May all materials could be downloaded without previous registration. We followed this approach due to the very strong renitence of German teachers on giving away their contact (e-mail) to a project. So the focus was on building trust. We estimate that about 2000 Users downloaded the materials (analysis of the IPs)

End of June all materials were uploaded: Only registered people could download the materials. The amount of downloads decreased a lot. Registered teachers increased to 108

- **Number of downloads by end of June 2015:**

End of June 7755 (4832 on the teachers-online page (a cooperation partner) and the rest from the ENGAGE Germany page

- **Most successful materials?** Please provide a list with the 5 ADOPT materials which have been most popular *in your country* (indicators: # of downloads and # of comments) please update
 1. Gen test yes or no (570)
 2. Ebola (500)
 3. Ban coke (490)
 4. Islands (480)
 5. Three Parents (430)
- **Comments by users for materials refinement/revisit:** *Have there been any negative comments on some materials or proposals for materials refinement/change? If yes please explain*

No

b) Workshop attendance

- **Has a workshop took place in your country?** Yes/No

The workshop will take place on the 20 and 23.10, not earlier because the materials were not ready before the summer break. WS takes place during the Autumn break.

c) Online course

- **When it is planned to take place?** Mid-October 2015
- **Number of teachers?** 10-30
- **Do you plan to combine it with ADAPT online course?** Yes
- **Main challenges of the online course:** Please provide one/two sentences on the main challenge (s) for implementation (if any) and how do you plan to confront it

Keep the ENGAGE teachers engaged in a MOOC that is not very innovative

d) Overall

Germany was among the countries that did not reach their targets. What were the main reasons/challenges? How do you plan to refine your dissemination strategy for 2nd year ADOPT?

We reached the target of getting more than 700 teachers involved (the number of downloads is very high) but a low number of registrations. This is a particular situation due to the fact that in Germany teachers are not used and willing to register and give feedback to a portal they don't know yet. That is the reason why we first tried to build trust by involving a) a partner organization (Teachers-Online with a community of 500.000 Teachers) and b) materials could be downloaded without registration.

Now we are developing more dissemination materials (project trailer, short flyer) in order to increase the number of registrations.

FRANCE

Contributor: Vanessa Migron (TRACES)

a) Materials usage

- **Number of teachers** who are registered by end of June 2015: 101 (700 promised in the Dow)
- Number of downloads by end of June 2015: 367
- **Most successful materials?** Please provide a list with the 5 ADOPT materials which have been most popular *in your country* (indicators: # of downloads and # of comments)

1. Ebola - 30 downloads and 0 comments
2. Manger des insects - 29 downloads and 0 comments
3. Bannir les sodas ? - 23 downloads and 0 comments
4. L'attaque des virus géants - 22 downloads and 0 comments
5. Crise du cacao - 18 downloads and 0 comments

- **Comments by users for materials refinement/revisit:** *Have there been any negative comments on some materials or proposals for materials refinement/change? If yes please explain*

No negative comments have been posted.

We could mention a constructive criticism: "Thank you for these excellent document. I find a pity to just concentrate in Bt modifications. This reinforce the ignorance and diversity of GMO's potential benefits. Maybe a second document "the faucheur are thy right or wrong" would allow to discover this other cases, often blocked upstream".

b) Workshop attendance

- **Has a workshop took place in your country?** Yes
- If YES, please provide the following info:
 - Number of participants: 7
 - Date: 8th of April 2015 (The workshop of the 2nd of April was for students)
 - Tools presented/discussed (Dilemma and/or group discussion)
 - Main outcomes (2 sentences on how successful they have been and on which respect)

We presented Car war. We get a very positive feedback on this activity and on the dilemma tools in general. But teacher were expected more theoretical background on IBSE.

c) Online course

- **When it is planned to take place?** Starting November 2, 2015.
- **Number of teachers?** How many teachers do you expect to participate? 25

- **Do you plan to combine it with ADAPT online course?** No
- **Main challenges of the online course:** Please provide one/two sentences on the main challenge (s) for implementation (if any) and how do you plan to confront it

This will be our first online course. The challenges will be:

- to have registrations,
- to be relevant to the daily practices of French teachers
- and to provide a good level of interaction.

We have planned a dissemination strategy for the MOOC and are customizing the MOOC for the French audience.

d) Overall

Given that France was among the countries who did not reach their targets, do you plan to refine your dissemination strategy for 2nd year ADOPT? (Please see your refined dissemination plan on May 2015)

Dissemination strategy has already been modified (*). An extra collaborator was hired to work specifically on dissemination. An external company, specialized on educational networks and on-line resources, has been subcontracted. A massive campaign will start at beginning of October 2015.

(*) The Revised Dissemination strategy of France follows:

ENGAGE projet in France

30 april 2015

Matteo Merzagora and Vanessa Mignan

TRACES



State of the art

The French system

The French system is strongly centralized. The Ministry of National Education through the system of 30 regional Academies manages all teacher CPD. Traces not being a teacher training institution, but rather a RRI think tank, there is a need of building a trust relationship with the inspectors and the academies they represent. This has determined some delays, as preliminary contacts were not conclusive, due to the need of showing a sufficient amount of material in order to convince them of its quality. These are now taking place and are expected to give the first result in the coming months.

The present situation

At today, the French Engage website has 2500 single visits, showing a quite good visibility of the website. Of these, only 19 teachers have actually registered, giving an engagement rate of 0,76%.

This low rate can be ascribed to several factors, and we do not have at present enough elements to provide a solid answer.

The strategy

Traces strategy to engage teachers is organised in two main strands:

- To ensure long term inscription of the ENGAGE project and material in the teacher CPD through a structured partnership;
- To directly advertise the resources through existing teacher and science networks, and online vectors.

Based on the above consideration on the French systems, we have initially decided to value the first element, that is the structuring of a trustful partnership with relevant keyplayers. However, some delay on our side, and the time lengths needed in establishing partnerships, also needing concrete materials available to guarantee the quality level of the proposal, has proven the initial strategy non-adapted to the strict deadlines needed for the project. The direct “marketing” to teachers and teachers network will be intensified. It is expected that this will produce a constant increase of teacher engaged in the project, with a peak that will be achieved after the summer break, thus displacing slightly the deadlines set in the DOW.

Action through partnerships

- Several meetings took place with inspectors for the Life science and Physical science disciplinary sectors of the Paris and its regions academies (Paris, Créteil, Versailles), in order to present them the project. Although the aesthetical presentation of the project initially posed some resistance, the relationships are now established, and the information on the Engage materials is being included in the Academies’ newsletters.
- A direct mailing to all French Academies, supported by the three academies of the Paris area, will take place on the 6th of May (end of spring school vacation in France: it was advised not to send any information to teachers before the end of Easter holidays).
- We have contacted the National Portal for teachers and the pedagogical portal for culture and science for teacher to include Engage resources.

- A special partnership was established with a major French training institution specialized in long life learning: the CNAM. The CNAM is also the national museum of arts and crafts. We developed with them an educational path for training and resources for teacher: *from History of science and technology to cutting-edge science*.
- Specific partnerships are being established with two major science education institutions: the *Fondation La main à la pâte* and the network of *Maison des sciences*.
 - o La main à la pâte is a long running initiative developing IBSE methods in the French system. They are currently developing their strategy toward junior and senior high school teachers
 - o The Maison des sciences is a newly established network of institution devoted to the training of teachers at regional level. These “Regional house of science” were created to help teachers to develop their science teaching practices, especially to allow teachers to build or strengthen relationships with current science and technology.

These are considered very relevant partnership for the development of the project, but they are not expected to give concrete results for adopt and adapt phases.

Direct actions through workshops

We delivered:

- 2 workshops on discussion tools related to life sciences on the 2nd of April 2015
- 1 training on the activity Car Wars for the Sustainable development colloquium of Versailles academy on the 8th of April 2015.

We will organise different events for teachers focusing on IBSE. The next event is planned for the 27th of May 2015.

Direct actions online

Although with some delay, a direct marketing strategy towards the target group has started and is being intensified. This included:

- Mailing to 5.000 recipients of the ESPGG newsletter (about 20% teachers)
- Inclusion of the Engage information in the newsletter of the Paris academies (on-going)
- Mailing to all French teachers involved in the UPD8 programme (66 Teachers)
- Direct mailing to about 100 secondary teachers previously participating to the activities of ESPGG

A second, targeted mailing to the ESPGG newsletter subscribers will take place in the first week of May.

Social networks

- Establishment of an ENGAGE France Facebook page: <https://www.facebook.com/engagefrance>
- Establishment of a ENGAGE France twitter account: <https://twitter.com/EngageFrance>
- Direct contact with leading, opinion making teacher blogs, such as:
 - o <http://www.pearltrees.com/t/sites-professeurs-svt/id4449676>
 - o <https://isabellequentin.wordpress.com>
 - o ...

Actions through teacher networks

At the comeback from the spring vacation, we are launching direct contact with French teacher associations, and organised teacher communities, often gravitating around leading science education bloggers.

As examples of such associations:

Union des Professeurs de Physique et de Chimie:

www.udppc.asso.fr/

APBG Nationale » Association des professeurs de biologie et de géologie :

www.apbg.org

AFPSVT | Association pour la Formation des Professeurs en SVT

afpsvt.fr

Association des Prof. de Sciences Physique - Académie de Grenoble

www.ac-grenoble.fr/apisp/

APISP : Association des professeurs "initiation aux sciences physiques"

<http://apisp.fr/>

Forum des professeurs de Physique Chimie

<http://physiquechimie.forum.free.fr/>

Actions through other networks

Scientific institutions

Several French scientific institutions have launched outreach programmes including work with teachers. In May-June an intensive phoning and mailing will be launched to disseminate Engage products linked to their centre of interest (Energy for the CEA ; health for INSERM ; digital world for INRIA, Sustainable Development INERIS ; etc.). Based on our experiences, it is believed that information coming from well known institutions will have a greater chance to transform simple visits in actual registration to the website.

Informal science communication networks

Science centres and science education NGO will be contacted in the occasion of two major conferences in which Traces will participate and present the Engage project:

- The AMCSTI conference (June 23, 24, 25)
- The Science & You conference in Nancy, where Traces will have a stand (June 3, 4, 5)

Action through the media

We are considering a advertising in the journals *La Recherche* and *Le mensuel – Café pédagogique*.

ROMANIA

Contributor: Laura Monica Gorghiu (VUT)

a) Materials usage

- **Number of teachers** who have used the materials by end of June 2015: *183 users*
- **Most successful materials?** Please provide a list with the 5 ADOPT materials which have been most popular *in your country* (indicators: # of downloads and # of comments)
 1. Making Decisions - 255 downloads
 2. Ban Cola? - 236 downloads
 3. Sinking island - 172 downloads
 4. Ban the beds - 164 downloads
 5. What does the fox say? - 133 downloads
- **Comments by users for materials refinement/revisit:** *Have there been any negative comments on some materials or proposals for materials refinement/change? If yes please explain*

The Romanian teachers' comments were generally related to the fact that they cannot implement the ENGAGE activities into the classroom as these have been designed, due to the Romania strict curricula content and to the limited number of hours at the teachers' disposal. They had to pick up only parts of these activities and tried to introduce them when the time allowed them.

b) Workshops attendance

- **Please review info and check for accuracy**

In Romania the ADOPT Workshop was organized on 6th of June 2015 and it was entitled "Modalități de adoptare a dimensiunilor RRI în predarea Științelor" ("Ways adopting RRI dimensions in Science teaching"). We had a number of 25 participants who act as in-service teachers in lower and upper secondary level of education (Physics, Chemistry and Biology teachers).

In order to evaluate the impact of the topics presented in the frame of the workshop, we applied at the end of the workshop a reflection sheet designed to capture the views of teachers involved in the workshop.

The Reflection Sheet was divided into two sections, namely one that targeted the perceptions of teachers on what they learned in the workshop and the second who wanted to surprise the opinions of the participating teachers on the effects that workshop will take over their subsequent teaching activity.

The target group that fulfilled the Reflection Sheets was composed by approx. 35% Physics teachers, 33% Chemistry teachers and 32% of Biology teachers.

Data collected from the investigation were processed by statistical and mathematical analysis and combined with a qualitative assessment based on the direct discussions with the teachers.

Being asked to grade the relevance of RRI aspects in the examples presented during the meeting (on a 5 steps Likert scale - Totally, To a great extent, Largely, To a small extent and Very little), the teachers' answers proved that this issue was very well received by them. Thus, 67% of them appreciated that the examples presented during the meeting were totally relevant to emphasize the RRI aspects and 33% appreciated to a great extent that the examples presented during the meeting were relevant to emphasize the RRI aspects.

Concerning the influence that the purchases acquired during the workshop on the current teaching practices, the answers were divided as follows: 21% of teachers considered that acquisitions in the workshop will totally influence the current teaching practices, 71% appreciated that the acquisitions gained during the workshop will influence to a great extent the current teaching practices, while the rest of 8% of the teachers appreciate the same aspect to influence to a largely level their current teaching practices.

The fact that the majority of responses is on the higher steps of the scale and that none of the respondents have ticked answers for values below the mid scale of assessment (to a small extent, very little) leads us to the conclusion that the workshop was effective and successful and might produce significant changes on the current teaching practices in Romania (at least to the participants' level).

Relating to the expected educational outcomes registered to the students' level involved in the lessons where teachers will apply what they learned in the workshop, the teachers appreciate that they will be improved very much (38%), much (55%) and to a moderate level (7%).

These teachers' expectations can be attributed to prospective vision that they exhibit, reported on developments in Educational Sciences in general (curriculum paradigm, the student-centered paradigm etc.) and the Science Education, in particular, (RRI, PBL, IBSE, integrated approach etc.)

From the perspective of optimizing its teaching approach as a result of participation in the workshop:

- 13% of teachers consider that the most important element was the teaching strategies presented,
- 42% think that the most important thing for them was the information on the integration of RRI in the lessons of Sciences (using the dilemma lessons),
- 25% appreciate that the most important were the ENGAGE materials used as examples to integrate RRI aspects in Science lessons (involving dilemma and group discussions into the lesson activities) ,
- for 9% of the teachers more important was the exchange of experience between practitioners and teachers (group discussions concerning RRI aspects)
- for 8% of teachers more important was the development of interdisciplinary connections and the connection between theory and practice,
- and for the remaining 3% of teachers the most important issue was related to the need to place the student in the role of researcher and teacher in the role of facilitator of the investigation.

- **Main outcome of the workshop (s)** - *Please provide a couple of sentences on the main outcome of the workshop (s), how successful has it (have they) been and in which respect.*

Most teachers from the target group (71%) think that the connections between science and everyday life represents the achieved element during the workshop with the greatest impact on the learning activities of students, while 13% of teachers give the highest importance rate to the training / development of investigative skills, 5% of the teachers give the highest rate to the training / development of resolution skills and the remaining 11% of teachers appreciate that the most important aspect they learned is related to the students' involvement in decision-making process during the Science lessons.

These responses demonstrate, once again, that Science teachers from Romania acknowledge the need to reform the teaching of scientific disciplines, in line with European Community policies and with the new type of citizen that must be trained by the contemporary education.

c) Online course participation (pilot on line course)

- **When it took place?** Period: 23rd of February – 10th of April 2015

- **Number of teachers?** How many teachers participated? How many were enrolled and how many completed the course?

We enrolled in this pre-test on-line course 10 prospective teachers (students who will become teachers). Only 5 of them completed the course. The main reason was concerned by the difficulties encountered by the participants to login to the edX platform, to enter in the space dedicated to the on-line course and upload their tasks. Due to this reason UVT kept the connection with Lattanzio Learning, Italy (who administrate the edX platform) and Open University, UK (the partner responsible for MOOC organizing) and communicate all the technical difficulties. Consequently, Lattanzio Learning partner decided to reinstall a new version of edX platform during 15th of April – 15th of May.

- **Comments by participants:** *If there are available data, please provide some comments by the participants on their expectations before the course and their feedback after completing the course*

Participants' answers to the question "What were the most useful activities?" comprised the following: presentation about dilemma lesson, presentation about group discussion, and the forum discussion for planning a lesson.

85% of participants considered that the use of ENGAGE activities will make the lessons more enjoyable and fun for students. However, participants agreed that in order to implement such kind of materials into the Science lessons request more time than normal teaching activities and a higher effort from the teachers' part to plan and follow the lesson activities.

To the question "Any other comment? What can we do better next time?"

5. I was not able to do complete the course. The 500 error not allow me to work properly.
6. Yes, I and my colleagues had a lot of problems to enter in the on-line course space. We had a lot of errors when we wanted to log in.
7. I like the course, but the tasks are very ambiguous.
8. Suggestions: a) reminder e-mails; b) more time for assignments; c) keep the course interesting.

Concerning what are the participants' suggestions for the course improvement, these were the following: More practice examples; to resolve the IT problems with the platform; more interactivity; I think that the tasks are ambiguous, and the site is very complicated; increase the connectivity between learning materials presented each week by reinforcing cohesive themes in the course structure. The most pregnant problem encountered not only by the participants but also by the tutors during the pre-test course period was the "500 error" given by the edX platform.

- **Main outcomes of the pilot online course:** Please provide one/two paragraph (s) on the overall implementation of the pilot online in Romania, anticipated positive outcomes, challenges faced, indicators of success

The most important goal of the pilot course in Romania was to emphasize the possible difficulties that participants can face during the course activities. If we look at the participants comments we can say that the goal was achieved, because with the help of the participants we could identify what are the technical problems and what do we have to do in order to solve them, what are the most useful activities (parts) of the course from the participants' point of view, what are the parts of the course that are not very clear for the participants and should be polished. However, we also

have to take into consideration that participants involved into the pre-test course didn't have a great experience of teaching, they are prospective teachers involved only in some practical activities into the classroom during the specific "Teacher training Module" activities. Probably this aspect can explain in a certain measure some of their answers.

In addition, we have to underline that RRI is a new thing for all the teachers and teachers' educators in Romania. Probably we will need more time to clarify them what is it and how to implement the RRI dimensions in their normal classroom. Probably we will need also more time to learn them how the ENGAGE activities can be integrated into their lessons and much more time to convince them to change their way of teaching, in order to get more interest from their students.

d) Way forward

Which have been the successful elements of your strategy to engage teachers? Which have been the elements that you would refine for ADOPT 2nd year? Please provide a paragraph

Probably we will need more face-to-face meetings with the teachers in order to introduce them into the RRI dimensions and how to integrate them into the Science lessons. Even the course was designed as an on-line course, probably some face-to-face meetings (workshops) with teachers can help us to guide them and convince them to use the limited time that they have at their disposal to introduce the ENGAGE materials in their lessons. We also not exclude the possibility to try to get the accreditation for this course, in order to have more interested teachers to participate to this course, since there are a lot of other courses promoted in Romania that offer them ECTS. This involves an additional effort from our team in order to achieve all the national requirements.

ISRAEL

Contributor: Yael Swartz (WZ)

Dissemination

General

Inform contacts about new materials – by expertise (chemistry teachers, life sciences teachers, physics teachers etc.)

Introduce ENGAGE site in conferences and other teaching courses.

Ask teachers who participated the TOOLS pilot to write a review

Set up meetings with target teachers

Actions: (not including emails)

Date	Activity	No. of teachers	other
26/10/2014	Opening a 28 hours PD – presenting engage, piloting the dilemma and discussion tools	6	Face to face, all teachers are implementing these days at least one engage unit

10/11/2014	Opening a 30 hours PD – presenting engage, piloting the dilemma and discussion tools	15	Online – using moodle
23/12/14	Presenting engage project, through Ban coke activity	30	F2f
23/12/14	Distributing engage brochure to chemistry teachers in a conference	200	brochure
7/1/15	Presenting engage in a PD for chemistry teachers	10	F2f
11/1/15	Presenting engage to pre-service teachers. demonstratng EBOLA activity	20	F2f
23/02/15	Presentation of the Engage project to teaching certificate students.	12 people, all with academic background in chemistry (MSc and Phd)	F2F + Brochure
10/3/2015	Presenting engage framework to our colleagues in Weizmann	15 people, about half of them are also in-service teachers	
30/03/2015	Presenting engage poster and brouchre in a teachers' conference	200	Poster, brochure
31/03/2015	Presenting engage as part of a debate activity to biology teachers	15	F2f
12/04/2015	Presenting engage pilot study at NARST	-	-
25/05/2015	Distributing engage brochure to Science for all teachers in a conference	150	
25/05/2015	Presenting engage in a parallel session in the science for all teachers	15	F2f

	conference		
13-16/07	30 hours PD – presenting engage, piloting the dilemma and discussion tools	22	F2f
03/09/2015	Presenting ENGAGE poster and PD at ESERA conference	-	-

a) Materials usage

- **Number of teachers** who have used the materials by end of June 2015:
- Number of teachers participated in workshops: 160
- Number of teachers registered in the website: 432
- No. of downloads: 73
- **Most successful materials?** Please provide a list with the 5 ADOPT materials which have been most popular *in your country* (indicators: # of downloads and # of comments)
 1. Ban coke
 2. Giant viruses
 3. Three parents
 4. Grow your own body
 5. Ebola.....equal to making decisions
- **Comments by users for materials refinement/revisit:** *Have there been any negative comments on some materials or proposals for materials refinement/change? If yes please explain*

Most comments are very positive.

Positive feedback – Israeli teachers

Appliance science: very interesting activity. It is relevant to all teen-agers in different levels of scientific knowledge. It exposes the teens to scientific concepts and make them think about the topic from a different point of view then that of their daily life. This activity provokes various dilemmas and encourages critical thinking and decision-making.

Chocolate money: interesting topic

I am a teacher and chocolatier. I often uses chocolate as an example to many topics. I will use this activity in the classroom to show other directions. Thank you for the new information

GM decision: This activity is based on students' sharing their own ideas and views. Learning is fun and not boring. It is relevant both to the curriculum and to daily life. The teacher needs a good background on genetic engineering. Relating to this activity – more scientific information for the teachers is needed

Three parents: interesting, relevant, and enriches students' knowledge. Some former information is needed for meaningful learning and for making a well-reasoned view.

Ebola: A very interesting and relevant activity. It is in the media recently. The activity presents the dilemma very clearly, provides facts on Ebola virus and vaccine. Then students' are provided with various views and sources as well as a clear way to consider pro and cons and make a decision whether to take the vaccine or not.

Car wars: The activity is really nicely combining the problem of air pollution and global warming. The students hear a lot about these topics but the dilemma of buying a car is a nice application of the consequence for decision making – How to save energy, how to use energy efficiently and in a less polluting manner. The topics of energy, ecology and global warming are well woven together. Cars is a topic that "speaks" to the students.

Grow your own body: very interesting dilemma. Need more scientific background. Can be combined with another dilemma of organs donation

Making decision: An activity with clear goals. Provides a variety of teaching strategies: cards, videos, working in pairs, thinking individually. It requires high order thinking skills, and understanding of scientific processes. Thinking and decision making are well guided and structured.

Ban the beds: I loved the activity. The graph presented was a bit too difficult to understand.

Some refinement remarks:

Chocolate money: this activity is suitable also for younger using a specific video is recommended, adding more biological information, a suggestion for classroom activity: composing riddles on the topic.

GM decision: more scientific background for the teachers is requested

Take the test: A few comments regarding the Power point presentation: the goal of the activity is not clear enough, more information about the asked questions and possible answers is required. Some slides are overloaded

Car wars: More scientific issue about the different fuels and about the volume of CO₂ that is expelled is needed. Make decisions: The power point is not organized conveniently. The cards should be divided from the presentation, also not clear what is the teacher role in the cards activity

b) Workshops

- Please review info on the table and check for accuracy

	# teachers	Data	Pilot or not	Evaluation
Israel	6	26/10/2014	Opening a 28 hours PD – presenting engage, piloting the dilemma and discussion tools	Face to face, all teachers are implementing these days at least one engage unit Q2 will be sent by mail
	15	10/11/2014	Opening a 30 hours PD – presenting engage, piloting the dilemma and discussion tools	Online – using moodle and not EdX
	30	23/12/14	Presenting engage project, through Ban coke activity	f2f
	20	11/1/15	Presenting engage to pre-service teachers. demonstrating EBOLA activity	f2f
	15	31/03/2015	Presenting engage as part of a debate activity to biology teachers	f2f
	10	13/3/2015	Opening a 30 hours PD – presenting engage, piloting the dilemma and discussion tools	f2f We will use the questionnaires
	15	25/05/2015	Presenting engage in a parallel session in the science for all teachers conference	F2f
	22	13-16/07	30 hours PD – presenting engage, piloting the dilemma and discussion tools	F2f

- **Main outcome of the workshop (s)** - Please provide a couple of sentences on the main outcome of the workshop (s), how successful has it (have they) been and in which respect.

Main outcomes were teachers awareness to the following topics: 1) presenting socio-scientific issues, 2) discussions 3) argumentation

They acknowledge that these are important but tend to work according to the formal curriculum and not use ENGAGE materials as is.

c) Online course participation (on line course)

- **When it is planned to take place?** We open registration in October for a workshop of adopt and adapt together, that will start in November 2015
- **Number of teachers?** Estimated number 20-25 teachers
- **Main challenges of the online course:** One challenge is regarding the time framework: Here at least 30 hours course is considered for teachers' cresentation, therefore we had to add more activities and teaching materials

The second issue is the MOOC – In israel most of the teachers work in MOODLE environment and it is supported by the ministry of education, we are concerned about teachers use of EDx.

d) Way forward

Which have been the successful elements of your strategy to engage teachers? Which have been the elements that you would refine for ADOPT 2nd year? Successful strategies for dissemination:

Working on a 30 hours course to ensure the teachers get credit for their time

Using our connections – we asked to be invited to other PD programs only to present ENGAGE and even one tool (we were usually invited to have a 1/5-3 hours session)

Be present at most science teachers' conferences in the country, and presenting ENGAGE in the parallel sessions.

Pedagogical successful approaches: to have teacher experience one activity as students (for example, the EBOLA activity was found to be very suitable)

Have teacher debate on a socio-scientific issue

In the future we intend to have an ADOPT-ADAPT combined workshop to fulfill the minimal hours required for teachers' credit.

SPAIN

Contributor: Silvia Alcaraz


a) Materials usage


- **Number of teachers** who have used the materials by end of June 2015:


By 30th of June 2015: 423 teachers signed up


By 31st of August 2015: 452 teachers signed up


These data has been collected from the admin pannel of the Spanish Wordpress site for Engage by using the menu "users" > "ELS user statistics"


Dashboard


Posts


Media


Pages

Comments

Descargas

Newsletters

Contact

Appearance

Users Statistics

Cumulative

Start date:

End date:

Post category:

General

Show

Metric	Value
Teachers signed up	423
Materials downloaded	2553
Teachers reviews	64
New posts of type	5

Dashboard

Posts

Media

Pages

Comments

Descargas

Newsletters

Contact

Appearance

Users

Users Statistics

Cumulative

Start date:

01-01-2014

End date:

31-08-2015

Post category:

General

Show

Metric	Value
Teachers signed up	452
Materials downloaded	3420
Teachers reviews	64
New posts of type	5

- Number of downloads by end of June 2015 &

Most successful materials? Please provide a list with the 5 ADOPT materials which have been most popular *in your country* (indicators: # of downloads and # of comments)

Downloads	Month						
Material	2015_Jan	2015_Feb	2015_Mar	2015_Apr	2015_May	2015_June	TOTAL
Take the test	0	18	35	68	72	9	202
Sinking island	0	0	26	3	3	6	38
Ban the beds	0	17	15	6	6	9	53
Attack of the giant viruses	4	12	18	16	16	3	69
Ban cola	3	20	33	12	14	27	109
Car wars	0	2	23	0	4	3	32
Grow your own body	0	21	28	0	3	4	56
3 parents	3	28	18	14	14	15	92
What does the fox say	0	19	22	4	4	13	62
Making decisions	0	10	12	10	8	10	50

Ebola	0	15	15	0	0	12	42
Solar roadways	8	28	74	26	26	22	184
Eat insects	6	34	11	6	8	7	72
Appliance science	22	43	56	31	36	87	275
Chocolate money	5	42	45	18	18	13	141
Big Bag Ban	0	20	61	26	26	53	186
Decisión transgénicos	0	0	42	49	49	29	169
Text Neck	0	0	2	28	29	23	82
Invasion	0	0	1	36	36	10	83
Vida en Encélado	0	0	0	0	0	54	54
TOTAL	51	329	537	353	372	409	2051

The number of downloads is correct: five most successful materials are 1) appliance science; 2) Take the test; 3) Big bag ban; 4) Solar Roadways; 5) GMO

The most commented materials are 1) Big Bag Ban (17 comments); 2) Appliance science (7 comments); 3) Solar Roadways (6 comments); 4) Ban cola (5 comments); GMO (5 comments)

- **Comments by users for materials refinement/revisit:** *Have there been any negative comments on some materials or proposals for materials refinement/change? If yes please explain and give example*

Comments published on the website:

The attack of the giant viruses:

I would like to make a small contribution.

The table gives criteria for deciding whether a product is reliable or not, it is said to be unreliable when using the words "could", "might" ...

I think a newspaper article or even an investigation can use these expressions, for example in the conclusions, as we can tell that have opened some new hypotheses that are "credible".

In conclusion, I would change the criteria by: "plausible and testable hypotheses arise."

What does the fox say?

I have the problem that the reproduction of slides on Open Office doesn't work well. The worst thing is that I cannot hear the audio.

Ban cola:

The word "ban" is not well received by a teenager ...

In addition, we will make fewer sugary drinks consumed or will promote consumption of drinks with sweeteners?

GMO:

I believe that the evidence that provide for and against the use of GMOs in the material are very high bias in favor of GMOs that borders on the bias.

I think it's very important to generate discussion among students presenting honestly all data and opinions of prestigious scientists, not indoctrinate.

As it appears the material is published I therefore unusable.

Solar roadways:

Very interesting about a subject that seems to have aroused much controversy activity ...

I share some links I found by doing a not very exhaustive search which can be used for further information (especially for teachers)

The website of the company "Solar Roadways" (English):
<http://www.solarroadways.com/intro.shtml>

Article about it in the online edition of the science magazine Scientific American (English):
<http://www.scientificamerican.com/article/driving-on-glass-solar-roads/>

Article on the feasibility of the project to complement the video "More Information" (Spanish):
<http://www.vanguardia.com/actualidad/tecnologia/264923-son-posibles-las-carreteras-solares>

An article for the "International Journal of Engineering Research and Applications" that analyzes and describes the solar road (English):
http://www.ijera.com/papers/Vol3_issue3/IJ3314291436.pdf

Article in the magazine "Popular Mechanics" which discusses the difficulties and advantages of the project des from an urban perspective (English):
<http://www.popularmechanics.com/technology/infrastructure/a10730/we-could-build-a-solar-powered-roadway-but-will-we-16879565/>

Ideas for new materials received from a teacher:

- The duration of some technological products, planned obsolescence. What can we do? That is being done from the RRI. Examples of success as Fairphone ...

- Study how to extend the life of clothing ... like replace or improve some productive processes related to clothes (sandblasting, bleaching, water consumption,...)

- Understand how current research and development lags behind because of politically motivated and / or economic factors, rather than for scientific reasons. I believe that there is a great work about ethics from here.

Comments received during workshops

- Could materials be available in Open Office or at least .PDF?
- "Sinking islands" suggests that islands are sinking, while what is really happening is that the sea level raises
- Can we have the materials in catalan language?

b) Workshop attendance

- Please provide feedback on accuracy on the data

Workshop 1:

Date: 9/3/2015

Number of participants: 48

Location: UPC - Campus Diagonal-Pedralbes

Length: 3h

Tools: Dilemma



Workshop 2:

Date: 05/05 from 17:00 to 20:00h

Number of participants: 30-40 (How many participated?) 18 completed questionnaires?

Location: UB - Campus Mundet

Length: 4h (3 f2f and 1 online)

Tools: Dilemma & group discussion





- **Main outcome of the workshop (s)** - Please provide a couple of sentences on the main outcome of the workshop (s), how successful has it (have they) been and in which respect.

Workshop 1:

- Most participants think that these are useful and valuable materials for attracting students' interest in science lessons nowadays. The materials have led to discussion among the participants, especially regarding the science content, such as the importance to restrict energy use to avoid the greenhouse effect (appliance science), and the need to reuse or recycle plastic bags (big bag ban).
- Participants thought of ways to include these materials in their lessons, the challenges they would face and how to overcome them.
- Participants are interested in receiving more training.

Workshop 2:

- Participants agree that ENGAGE materials can help students understand that science has implications in their daily life, which may increase their motivation to learn science
- Participants were keen to behave as students and go through the steps of the ENGAGE materials demonstrated
- Participants highly appreciate to learn classroom strategies to make their science lessons more appealing and engaging to students. The steps and tips to organise and carry out a group discussion were perceived as very useful because as science teachers, they are not used to organising discussions in class.

.....

c) Online course

- **When it is planned to take place?** Please indicate the period

In Spain we plan to deliver ADOPT + ADAPT together as a single course of 30 hours during October-November 2015, in collaboration with the Institute for Continuing Professional development for teachers, which belongs to Universitat de Barcelona.

The course will be certified by the institution that employs teachers from public schools.

- **Number of teachers?** How many teachers do you expect to participate?

100-150

- **Main challenges of the online course:** Please provide one/two sentences on the main challenge (s) for implementation (if any) and how do you plan to confront it

Completion rate: some teachers may find it difficult to stay motivated for the whole course if there is no physical interaction. Our strategies to face this challenge are:

- Quick and frequent response to participants' questions in the forum by the facilitators
- Possibility to organise synchronous activities such as webinars or question and answer online sessions
- Emphasis on complementary communication channels such as Facebook and Twitter

Plan-do-review model: some teachers may find it difficult to try an ENGAGE lesson during the online course because they plan their lessons long in advance. We plan to face this challenge by:

- Explicitly convey the benefits of the plan-do-review model for their professional development
- Emphasize the "ready-to-use" nature of the ENGAGE materials
- Show that other teachers have already used the materials

d) Overall

Spain was among the countries that worked very hard to reach the targets. Which have been the elements of your strategy which led to success? Any plans for refinement of the strategy? Please provide a paragraph

- Participating in face-to-face events such as science fairs for teachers and/or students in different parts of Spain: Barcelona, Madrid, Sevilla
- Creating synergies with other European projects in Spain with complementary goals
- Strong and frequent presence in social networks (websites of teacher associations, online teacher communities, twitter, facebook)
- Publishing the link to the materials in online repositories

- Improving the “contact” form of the ENGAGE site in Spanish

Shortening the messages sent in our newsletter, i.e. more clear and co

NORWAY

Contributor: Harald Bjar

a) Materials usage

- **Number of teachers** who have used the materials by end of June 2015: *90 registered as of June 30th 2015*
- **Most successful materials?** Please provide a list with the 5 ADOPT materials which have been most popular *in your country* (indicators: # of downloads and # of comments) please check for accuracy
 1.Ban Cola (24 downloads)
 2. Appliance science (22)
 3.GM decision (22)
 4.Invation (22)
 5. Solar roadways (22)
 6. Three parents (22)

Only one user comment registered by June 30th (for Ebola, very positive response)

- **Comments by users for materials refinement/revisit:** *Have there been any negative comments on some materials or proposals for materials refinement/change? If yes please explain and give example*

No negative comments (one comment giving positive feedback for Ebola, see above)

b) Workshop attendance

- Has a workshop took place in your country? Yes/No YES
- If YES, please provide the following info:
 - Number of participants...18
 - Date....June 5th
 - Dilemma and group discussion tools were presented
 - Main outcomes: The participants were happy with the course and found the tools useful

c) Online course

- **When it is planned to take place?** Please indicate the period

From 2nd half October – December (ADOPT+ADAPT)

- **Number of teachers?** How many teachers do you expect to participate?

5-10

- Do you plan to combine it with ADAPT online course? Yes
- **Main challenges of the online course:** Please provide one/two sentences on the main challenge (s) for implementation (if any) and how do you plan to confront it

Recruiting participants may be challenging. Mainly we plan to send e-mails to the registered users of the website, inform participants on the national conference for science teachers this autumn and use social media

d) Way forward

Which have been the successful elements of your strategy to engage teachers? Which have been the elements that you would refine for ADOPT 2nd year? Please provide a paragraph

The Norwegian site has been updated with new materials on a regular basis and social media has been used to announce the updates. Links from national sites for science teachers to the Engage site have also been helpful for dissemination. For the recruitment of teachers to ADOPT workshop contacts with local schools have been important.

For the second year we plan to collaborate more strongly with regional schools, with a stronger emphasis on schools at higher secondary level. The materials on the Engage site will be updated to include a stronger focus on the curriculum at the higher secondary level.

Switzerland

Contributor: Ignacio Monge

a) Materials usage

- **Number of teachers** who have used the materials by end of June 2015:

42 -This is the number of persons (teachers and actors in education in Switzerland) that were registered in our website by the end of June AND that have downloaded at least 1 material.

- Number of downloads by end of June 2015: 300
- **Most successful materials?** Please provide a list with the 5 ADOPT materials which have been most popular *in your country* (indicators: # of downloads and # of comments)
 1. Ebola
 2. Eat insects
 3. Ban cola
 4. Attack of the giant virus
 5. Chocolate money
- **Comments by users for materials refinement/revisit:** *Have there been any negative comments on some materials or proposals for materials refinement/change? If yes please explain*

These preferences correspond to the users of the engage website in French: we cannot distinguish the differences between France, Switzerland and other French speaking countries.

Because of personal conversations with several teachers in Switzerland, I know that they have used **Ebola, Ban cola and Attack of giant virus** and that these were their preferred topics and that they liked them.

No negative comments.

I presented the Engage materials to science didactics experts at different occasions. Several feed-backs were given and I have already transmitted them to our colleagues in Engage. For example, it could be interesting to let the students build the dilemma themselves, by offering them images at the beginning, instead of proposing them “already made dilemma”.

b) Workshop attendance

	# teachers	Date	Info
Switzerland	17	May 9th (90min)	Workshop in the context of a public event on sustainable development, with many other contributions different from engage. Participants may answer the q/re, but they are not obliged to do it.

- please provide the following info:

- Tools presented/discussed (Dilemma and/or group discussion)

The dilemma and group discussion tools were presented, but there was not enough time to exercise them (workshop duration 90 min).

- Main outcomes (2 sentences on how successful they have been and on which respect)

The workshop helped to have Engage more publicly known (there were several hundred participants in this congress about sustainable development).

One participant that works at the pedagogical school in Bern has contacted us recently and asked us to organize a workshop for german speaking high school teachers in April 2016. This is very positive!

c) Online course

- **When it is planned to take place?** Please indicate the period

.....November 2nd 2015 – December 11th 2015

- **Number of teachers?** How many teachers do you expect to participate?
...We do not know yet. We expect about 8.
- Do you plan to combine it with ADAPT online course? Yes.....
- **Main challenges of the online course:** Please provide one/two sentences on the main challenge (s) for implementation (if any) and how do you plan to confront it

It is the first time for me, this is already a challenge. We are getting prepared here. It is a help that there will be two adopt workshops before, which will help to have more experience with the contents and tools.

Another challenge: finishing the ADAPT tools content. This is being done now and we will have to communicate very well to be ready for November.

d) Way forward

Which have been the successful elements of your strategy to engage teachers? Which have been the elements that you would refine for ADOPT 2nd year? Please provide a paragraph

Successful elements:

Presenting the Engage project to science didactics and pedagogical experts in several different meetings in Switzerland. I think that this makes it easier to go then to teachers that are working on the field.

The fact that I have done myself several CPD courses and that I have been working myself as a secondary teacher here in Fribourg in the past is helpful: I know already many teachers, coordinators and experts.

Having a personal contact with teachers and coordinators is important (phone calls, skype, f2f meetings).

2nd year strategy

The 5h workshops this autumn are essential to continue dissemination, so as the online course. We will propose further workshops in other places.

Continue with the Newsletter.

LITHUANIA

Contributor: Dalius Dapkus

a) Materials usage

- **Number of teachers** who have used the materials by end of June 2015:

The period of 2014 - July 2105:

Teachers signed up - 203

Materials downloaded 3823

- **Most successful materials?** Please provide a list with the 5 ADOPT materials which have been most popular *in your country* (indicators: # of downloads and # of comments) please complete
 1. Ban Cola?....
 2. What does the fox say?....
 3. Attack of the giant viruses.
 4. Ban the beds....
 5. Car Wars....
- **Comments by users for materials refinement/revisit:** *Have there been any negative comments on some materials or proposals for materials refinement/change? If yes please explain*

The majority of comments are very positive. There were just one comment saying that “ the translation of the material is word by word with style mistakes and that it was necessary to consult a biologist for the translation”. When we asked personally the author of this comment to explain in detail about the mistakes, she refused to do that stating that she wrote this comment in a hurry.....

b) Workshop attendance

23 January, 2015 - 91 science teachers participated.

1 April, 2015 - 43 science teachers participated.

2 April, 2015 - 51 science teachers participated.

Tools presented/discussed (Dilemma and/or group discussion).....Both tools mentioned were presented.

Main outcomes (2 sentences on how successful they have been and on which respect)

All the seminars were quite successful. We organized the first seminar in January 23, 2015. On the demand of science teachers, especially belonging to the Association of Biology teachers of Lithuania, we organized two more seminars in April, 2015. We organized every seminar in two parts: the first half of a day was devoted to theoretical part (introduction to the ENGAGE project, explanation of ENGAGE tools, introduction to the website and materials created) and practical part for the second half of a day in computer classes (presenting the materials published on the ENGAGE website and explaining the concepts of their creation; working in groups for trying the materials simulating students' class situations). It seemed that materials created with RRI and dilemma aspects were very successful and could be used for students motivation in the class.

c) Online course

- **When it is planned to take place?** Please indicate the period

12/10/2015 - 8/11/2015.....

- **Number of teachers?** How many teachers do you expect to participate?

It is difficult to say. I hope it could be about 20-40 teachers.....

- Do you plan to combine it with ADAPT online course?

.....YES.....

- **Main challenges of the online course:** Please provide one/two sentences on the main challenge (s) for implementation (if any) and how do you plan to confront it

The main thing is to attract science teachers. The next thing is to keep teachers during the whole course, so it should be prepared quite attractively, what we prepare for.

d) Way forward

Which have been the successful elements of your strategy to engage teachers? Which have been the elements that you would refine for ADOPT 2nd year? Please provide a paragraph

One day seminars were really succesful among teachers, so we plan to organize 1-2 similar seminars in the future. We succeeded to disseminate our activities with the help of local teachers associations, especially the Association of Biology Teachers of Lithuania; this organization have a very broad contact list of science teachers and we plan to ask their help for the dissemination of our activities in the future as well.

CYPRUS

Contributor: Maria Evagorou

e) Materials usage

- **Number of teachers** who have used the materials by end of June 2015:

Teachers signed up - 15

(20 promised in the Dow)

Please check accuracy of the numbers – the number was accurate for June but we have 35 more teachers today

- **Most successful materials?** Please provide a list with the 5 ADOPT materials which have been most popular in your country (indicators: # of downloads and # of comments) please complete
 1. Ban the coke
 2. The island is sinking
 3. Three parents
 4. Car war
 5. Text neck
- **Comments by users for materials refinement/revisit:** *Have there been any negative comments on some materials or proposals for materials refinement/change? If yes please explain*

No. Only during the face to face meetings the teachers suggested changing the materials to make them more inquiry-based.

Problems/challenges reported: “contact is better on personal terms, this is not the best time of the year for teachers to try new things because the exam period is starting, Cyprus is a small country so the number of teachers is small”

f) Workshop attendance

Country	# of participants	Date/s of workshop	Pilot or not?	Evaluation?
Cyprus	19	April 3rd 2015 & May 13th 2015 November & December	pilot test both tools and evaluation tools with pre-service teachers We will run a workshop with in-service physics teachers in collaboration with the Pedagogical Institute of Cyprus	the first set of teachers (April) were not provided with a questionnaire. For the second meeting we will have a focus group to evaluate we will administer the questionnaire

- please provide the following info:
 - Tools presented/discussed (Dilemma and/or group discussion): Both dilemma and group discussion groups were presented, and also some materials from the website were discussed (three parents, text neck and chocolate money)
 - Main outcomes (2 sentences on how successful they have been and on which respect)

The most important comment that came out from all the teachers is that the workshop and on-line materials are useful, but they would prefer if they had time during the workshops to collaborate with other teachers and design their own materials that they can use in their classes specific to their curriculum. So they actually want to be designers themselves. We are actually implementing this as an activity in the workshops that will take place in fall.

g) Online course

- **When it is planned to take place?** Will start 3rd of November until mid December
- **Number of teachers?** The registration is still open and we are not sure on how many will register. Hopefully not less than 20 teachers
- Do you plan to combine it with ADAPT online course? Yes
- **Main challenges of the online course:** Please provide one/two sentences on the main challenge (s) for implementation (if any) and how do you plan to confront it

Teachers in Cyprus are not used to online courses, and they prefer face to face interactions. Therefore we plan to have a blended approach at first.

h) Way forward

Which have been the successful elements of your strategy to engage teachers? Which have been the elements that you would refine for ADOPT 2nd year? Please provide a paragraph

Teachers are interested in activities that are practical (have an inquiry-based approach) and can be implemented as part of the local curriculum. Therefore, the strategy previously used had to do with re-designing the materials during the workshops, and then providing support when the materials are implemented in the classroom. We will follow this strategy again for ADOPT 2nd year. Finally, it was easier to have a face to face meeting with the teachers before we could convince them to go online and check the materials.