DELIVERABLE D1.1: RRI Curriculum Document

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D1.1. RRI Curriculum Document

Version : Internal Review

1. Introduction

In recent years, the European Policy agenda has prioritized the reframing of 'Science in Society' to ***'Science for Society, with Society'*** (Owen et al, 2012) and the directing of science and innovation towards societal challenges Europe is currently facing and could face in the future (Lund Declaration, 2009). Especially in the last five years or so, the concern that the ***processes and products of research*** should be ***acceptable by society*** and ***relevant to public needs*** has been fallen under the framework of ***'Responsible Research and Innovation' (RRI)***. The RRI framework is still in the process of construction and conceptualization by relevant actors (Owen, 2012).; however, ***in educational contexts*** RRI mainly refers to the consideration that future European citizens are best equipped to handle the complex issues surrounding emerging technologies, are sufficiently literate about how science works, and have been exposed to ethical thinking, in order to participate in public debates and make informed choices.

The ***ENGAGE project*** has set out to contribute to the accomplishment of the challenging ***aims*** evident in RRI policy agenda, by targeting two main stakeholders' groups: teachers and students. On the one hand, the project aims ***at equipping teachers with skills and knowledge*** as to use RRI teaching techniques with the support of our exemplar materials; to move to a significant change in either their beliefs, knowledge or classroom practice; and to make substantial changes to their beliefs, knowledge and classroom practice. In this way, the project aims ***at making a contribution in students acquiring the knowledge and skills***, ***attitudes and behaviours*** that allow them to engage effectively with RRI-based science as future citizens and in their own lives.

The ***work reported in this study*** has been developed in the frame of the ***project's first Work Package (WP1),*** the main aim of which is to develop the theoretical framework under which the project will be implemented. The current work addresses the main aim of WP1 by ***providing the current picture of existing RRI curriculum in all participating countries***, under the scope of ***identifying barriers and opportunities*** for the accomplishment of the project's objectives. The ***science curriculum analysis*** covers ***11 European countries***, namely: United Kingdom, Greece, Germany, France, Romania, Israel, Spain, Norway, Switzerland, Lithuania and Cyprus. The science curriculum refers to ***11-16 years old students***, as research has shown most success at transforming teachers between the equivalent 'grades 7 to 10' – there is less pressure from external examinations and more time to experiment (Birkenhead, 2006). The study takes the ***reference year 2014,*** while changes and reforms planned for the coming years have also been taken into account.

2. Aims and purpose

The work reported in this document aims at ***informing the project at 3 levels***:

- at a 1st level, it targets to provide ***guidance for achieving the objectives of WP1*** (guidance for developing the RRI OER exemplar (T1.2), Prototype Courses (T1.3);
- at a 2nd level, it seeks to provide evidence that ***facilitate work within WP3 –*** **Resources**- (identification of specific RRI topics and any RRI curriculum areas), ***WP8 – Evaluation***-(background info for the current state of affairs – dimensions for evaluation under contextual perspectives) and the ***implementation WPs*** (barriers and opportunities for the implementation);
- at a 3rd level, it aims at ***serving the aims of the project as a whole*** (identify hindering and supportive factors to attain the main project goal, namely to support wide uptake of RRI approaches to teachers and students).

In relation to the purpose of this work, the ***expected outcomes*** of the curriculum analysis in the 11 European countries are the following:

- ***provision of background information*** for each country in terms of how RRI curriculum fits their national frameworks;
- ***elaboration on how easy or difficult*** will be in each country to implement RRI curriculum and pedagogy, i.e. what aspects are already part of most teachers current practice and which are nor used at all;
- ***identification of the opportunities*** that we should take advantage of and of the ***barriers*** for the implementation;
- ***provision of initial information on the hindering and supportive factors*** to attain the main project goals

Although the departure point of the work conducted and reported in this document has been the accomplishment of the specific objectives within the ENGAGE project, the hope is that the outcomes of the curriculum analysis are relevant to broader audiences interested in RRI thematic. Indeed, as mentioned earlier, the RRI framework is still in the process of construction and conceptualization by relevant actors (Owen, 2012). The results on the current situation in the countries' curricula may provide ***useful background information that can deepen understandings on the interrelations between intensions and current practices*** and on ***how to move RRI from words to deeds in a meaningful and constructive manner***, in educational contexts.

3. Methodology

In order to provide the current picture of existing RRI curriculum, surveys were conducted in the ***11 participant countries***: United Kingdom, Greece, Germany, France, Romania, Israel, Spain, Norway, Switzerland, Lithuania and Cyprus. The ***procedural method*** used was the following: At first, partners responsible for task T1.1. (RRI curriculum analysis) of WP1 developed a ***framework for the analysis of the countries' science curricula in terms of RR***I, for age groups 11-16 years old. In the process of drafting the framework, the outcomes of the ***preliminary analysis of the curricula*** in each country in terms of RRI were ***taken into consideration*** (see APPENDIX I). Indeed, on the very brief curriculum analysis we've done for the proposal, the following issues were identified in relation to national curricula that might have implications to the accomplishment of the project's objectives: teachers lack pedagogical knowledge on how to handle RRI topics; lack of suitable teaching materials; teachers lack knowledge about how science/technology work; RRI issues are not in the curriculum; RRI issues are not adequately assessed in formal assessment

With an aim to build on the preliminary results and acquire a more detailed picture of the science educational context in the countries, the following ***6 themes/areas of focus were addressed in the analytical framework:***

Theme 0: Science Education Background
Rationale: Information was gathered about the way science is taught at different educational levels across countries – disciplinary, interdisciplinary or multidisciplinary- in order to identify appropriate materials in each case.

Theme 1: Recent curriculum changes in relation to RRI
Rationale: Several counties are currently or recently been engaged in educational reforms, especially focused on science and technology education. We seek to gain an understanding on the changing educational scenery – mainly in terms of whether or not and up to what degree curriculum changes are in line with RRI philosophy. This aims at providing an overview of the 'general picture' and allows the identification of opportunities for the project.

Theme 2: Curriculum objectives and expected outcomes in relation to RRI
Rationale: A major aspect of the curriculum has to do with the objectives and the expected outcomes. Here we aim at gaining an understanding on what are main outcomes that the curricula foresee in relation to students' knowledge, skills, personal development, development of values etc, as well as where the focus lies in terms of students assessment.

Theme 3: Curriculum content and RRI
Rationale: One aspect of the curriculum is the one that relates to the content, i.e. the thematic areas on which the curriculum focuses and/or (maybe) prioritizes. We seek to gain an understanding on whether or not (and up to what degree) themes relating to socio-scientific issues, technology, values, nature of science are evident and prioritized in the curriculum of each country.

Theme 4: Pedagogical processes and RRI

Rationale: Another aspect of the curriculum has to do with the pedagogical processes that are proposed in the curriculum and that are actually implemented in the classrooms. We seek to gain an understanding on whether or not pedagogical strategies such as IBL and argumentation (that relate to RRI objectives) are evident and prioritized in each county curriculum.

Theme 5: Context (informal settings, society) and RRI
Rationale: Apart from formal education, informal education needs to be addressed and –if appropriate the broader societal dimension- i.e. RRI pedagogical strategies from within the informal science education and science centre communities, society-awareness of RRI. We seek to gain an understanding on the degree to which there are connections between schools and informal setting with an aim to support RRI objectives, as well as on the degree on which the broader societal communities – in which students are active members- are aware of and support RRI initiatives.

The themes relating to: Recent curriculum changes in relation to RRI; Curriculum objectives and expected outcomes in relation to RRI; Curriculum Content and RRI; Pedagogical Processes and RRI, were addressed under ***three levels of systematic analysis***: a) the macro-level regarding wider policy envisions; b) the meso-level – relating to the way schools mediate the implementation of policies and c) the micro-level – regarding actual implementation in the classrooms. The multilevel systematic analysis has been taken into consideration, in an effort to uncover probable contradictions of implementation in relation to intensions.

With the aid of the analytical framework, which determined the dimensions of educational context under investigation, partners in FORTH responsible for task T1.1 drafted ***a questionnaire*** to be used as ***a tool for gathering information*** in the surveys. The questionnaire was undergone an iterative cycle of improvements through the feedback of the consortium partners. The final version of the questionnaire (see APPENDIX II) was distributed and completed by WP1 partners in respect to their countries. In the process of completing the questionnaire, partners draw on their processional experience on RRI thematic, while –when needed - they consulted RRI experts in their countries.

The questionnaires were analyzed at first in terms of each country, resulting in ***11 case studies,*** one for each participant country. Each case study focused on the main themes presented above, with an aim to identify in each one them probable implications to the project, and in the whole, ***probable opportunities and barriers for the accomplishment of the project's objectives in each country***. The first draft of the case studies was distributed to the partners, which provided verification and feedback on the outcomes of the analysis in respect to their own country. The incorporation of the partners' feedback resulted to the final version of the countries case studies that are reported in this document that is presented in chapter 4 of this report.

Following the process of analyzing separately the educational context in each country in relation to RRI, the information provided in the national case studies were ***synthesised by identifying differences and commonalities among the participant countries***. In respect to ***each theme/dimension of curriculum analysis, a set of conclusions*** was reached and is provided in the last section of the report (chapter 5), leading to a set of ***recommendations***

for the various work packages within the project for more successful accomplishment of the ENGAGE objectives.

In parallel, in order to acquire more detailed picture in the piloting countries – and for providing guidance for developing the RRI OER exemplar (T1.2) SHU lead partners in the pilot to produce a draft set of Materials guidelines to guide the development of Materials that would be relevant to all countries. The guidelines consist of a set of spreadsheet grids, published in our 'Google Apps' platform so that all partners can view and collaborate. Together with the 4 pilot partners we:

- Identified all the science topics, covered between 11-16, and partners rating the importance of these in their national curricula
- Elaborated the 4 areas of our 'RRI curriculum' into a comprehensive list of concepts/skills to be covered
- Devised a list of emerging science and technology contexts, to ensure a broad, varied coverage.
- Created a list of teaching and learning strategies and formats, to increase the pedagogical quality

These guidelines acted as a set of criteria, to help us choose the 'best' ideas for Materials, in terms of how well they fit each partner's curriculum and how well they addressed our objectives and pedagogical approaches. This work will be reviewed, with the intention of achieving maximum relevance to the 12 partners in the roll out phase. Relevant to this work documents can be found in Appendix III.

4. Results

This chapter presents the outcomes of the questionnaire analysis for the 11 countries, in the form of 11 case studies which provide information on the following themes/dimensions relating to RRI curriculum: Science education overview; Recent curriculum changes in relation to RRI; Curriculum objectives and expected outcomes in relation to RRI; Curriculum Content and RRI; Pedagogical Processes and RRI; and Context (informal settings, society) and RRI.

Information regarding 11 countries is reported: UK, Greece, Germany, France, Romania, Israel, Spain, Norway, Switzerland, Lithuania, and Cyprus. In each case study and for each theme, probable implications to the project are identified, and in a summary, probable opportunities and barriers for the accomplishment of the project's objectives in each country.

4.1. RRI Curriculum Analysis for the case of UK

4.1.0. Background - UK

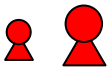
The main focus of this report is on schools in England, as other constituent nations of the United Kingdom are increasingly adopting different directions. Scotland has always had a different education system, whilst Wales and Northern Ireland often chose to adopt either new initiatives in response to suggested changes from England or maintain the status quo rather than making changes.

To provide a simplified overview of the educational system in England, the transition from primary to secondary sector is at the age of 11; the vast majority of the pupils attend non-selective schools that cater for all children from a local area and throughout they experience the National Curriculum that defines programmes of study focusing on learning up to age 7 (Key Stage 1), from age 7 to 11 (Key Stage 2), from age 11 to 14 (Key Stage 3) and in the last two years of compulsory schooling at ages 15 and 16 (Key Stage 4).

The national curriculum programmes of study for science at key stages 3 and 4 have been disapplied with effect from 1 September 2013 and are no longer statutory. This means that schools are free to develop their own curricula for science that best meet the needs of their pupils, in preparation for the introduction of the new national curriculum from September 2014. Science remains a compulsory national curriculum subject at all four key stages.

4.1.1. Recent curriculum changes in relation to RRI - UK

The table below provides an indication on the degree to which aspects of RRI philosophy are (or are not) emerging in current or envisioned educational changes both in policy rhetoric and in educational practice.

Changes relating to					
	…the envisioned curriculum				
	…the enacted curriculum				
	….teacher training				
		No change	***Not in line with RRI***	***Partly in line with RRI***	***In line with RRI***

 **Students 11-14 years old**

 **Pre-service teachers**

 **Students 14-16 years old**

 **In-Service teachers**

As evident in the table above, in terms of policy orientation for Key Stage 3 (11-14 years old) current changes indicate that RRI is a bit less emphasized than previously, but the areas that are present are more clearly defined. Areas of RRI that are present are the following: Evidence (testable explanations, quality of data, scientific community); technology (risk, evaluating risk issues); society (understanding the uses and implications of science, today and for the future); argument (evaluate solutions-but not explicit reference to the process of argumentation). For Key Stage 4 (14-16 years old) changes planned to be initiated in 2016 provide evidence that RRI is well emphasized and specified in the curriculum document. In particular, areas of RRI that are emphasized are the following: Evidence (testable explanations, quality of data, scientific community); technology (risk, perception of risk, evaluating risk); issues (ethical perspectives, decision making); argument (find evidence, write arguments, and evaluate solutions). It should be noted, though, that although aspects of RRI are evident in the proposed curriculum changes, science education seems to move towards more academic and knowledge-based objectives.

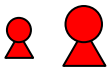
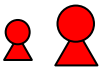
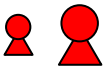
Nevertheless, despite the current changes in the country that indicate that aspects of RRI philosophy are emerging in policy documents, in the last three years no significant changes in the way science curriculum is implemented. In relation to the enacted curriculum, less emphasis is put on the nature of science and society implications mainly due to the perception that the syllabuses are becoming more knowledge-based. The perception that there is a renewed focus on fundamental academic knowledge in science education may be also the reason why aspects of RRI do not seem to be much prioritized both in pre-service and in-service teacher training.

Probable implications to the project:

- There is much policy change in UK at the time across school systems, structures and governance, curriculum and qualifications, initial teacher and continuing teacher education, with a renewed focus on fundamental academic knowledge. With ***change across all areas at the same time the challenge for the ENGAGE project is potentially significant.*** .
- Recent curriculum changes have not yet reached classroom practice; it is ***a challenge and an opportunity for ENGAGE to have an actual impact in the country, by facilitating the transformation of policy envisions to classroom implementation***.

4. 1.2. Curriculum objectives and expected outcomes in relation to RRI -UK

In the UK educational context, in terms of science curriculum objectives as evident in curriculum documents, highly prioritized are objectives that relate to the acquisition of scientific knowledge and the development of scientific skills and to a lesser degree to the development of values. Curriculum objectives are partly in line with RRI for Key Stage 3 and in line with RRI for Key Stage 4; this is an indication that in this country it might be easier to engage teachers in RRI teaching for the first case and more challenging in the second case. In terms of expecting outcomes, there seems to be compatibility between the envisioned objectives and what is assed in the exams. The fact that the main focus of formal assessment is put on the acquisition of scientific knowledge implies that RRI is inadequately assessed in the country; this might be a barrier for the accomplishment of the project goals. The following table summarizes information for the country in terms of the prioritized objectives in the science curriculum and in the formal assessment

Objectives and outcomes prioritized	***Acquisition of scientific knowledge***	Policy documents			
		Formal assessment			
	Development of scientific skills	Policy documents			
		Formal assessment			
	Acquisition of Values	Policy documents			
		Formal assessment			
			Not a priority	***Medium Priority***	***High Priority***

 **Students 11-14 years old**

 **Students 14-16 years old**

Probable implications to the project:

- Content-base objectives are rather more prioritized in the country in comparison to objectives that are more RRI oriented (for example the acquisition of values); this

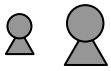
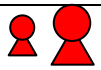
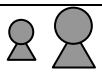
might be ***a hindering factor need to be taken into consideration in the process of engaging sciences teachers in implementing in the classrooms resources that relate to RRI objectives.***

- Given that curriculum objectives are partly in line with RRI for Key Stage 3 and in line with RRI for Key Stage 4, in a first view it seems that ***it might less challenging to engage key Stage 4 teachers in RRI teaching than Key Stage 3 teachers***. However, according to the comments of the UK partners –in the verification process of the outcomes of the analysis – ***the opposite is more likely the case***: **it is more challenging overall to engage key stage 4 teachers, even though there is a bit more in the curriculum about RRI.** This has been UK partners' experience from 'science upd8' curriculum development for many years. The main reason is external assessment; this is high stakes at 16 year old, so teachers preparing students for these exams will not diverge from the exam syllabus to consider things like issues, or engage in discussion as much.

- The fact that RRI aspects are ***inadequately assessed in formal assessment the country might be a barrier*** for the accomplishment of the project's objectives; ***specific guidelines to the teachers on how RRI objectives can be assessed*** – along with guidelines on implementation of RRI strategies – would benefit the broader uptake of the project' s recourses and materials.

4.1.3. Curriculum Content and RRI (socio-scientific issues, technology, values, nature of science) - UK

This section aims to provide an understanding on whether or not (and up to what degree) themes relating to socio-scientific issues, technology, values, nature of science are evident and prioritized in the science curriculum of the country.

Curriculum content in the areas of	***…socio-scientific issues***	Curriculum			
		Assesment			
		Teacher training			
	…technology	Curriculum			
		Assesment			
		Teacher training			
	… values	Curriculum			
		Assesment			
		Teacher training			
	…nature of science	Curriculum			
		Assesment			
		Teacher Training			
			Not Evident	***Evident but not prioritized***	***Evident and prioritized***

 **Students 11-14 years old**

 **Students 14-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

As summarized in the table above, curriculum content relating to RRI for Key Stage 4 (14-16 years old) is more evident and prioritized than for Key Stage 3 (11-14 years old). Thematic areas that are more evident and prioritized and relate to RRI for Key Stage 4 are: genomics, genetic engineering, stem sells, reproductive technologies, biodiversity, new materials (e.g. graphene), life cycle assessment, and nanotechnology. On the other hand for Key Stage 3, as UK partners reported content relating to the nature in science is more evident and prioritized than content relating to socio-scientific issues, technology and values. In terms of teachers' background in teaching issues on RRI thematic, it should be noted that RRI thematic is evident but not prioritized both in in-service and pre-service teacher training. ENGAGE workshops and online courses on teacher training of RRI materials may prove particularly helpful in this regard.

Probable implications to the project:

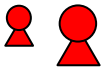
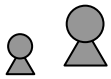
- In terms of content, for ***age group 12-16***, ***resources relating to genomics, genetic engineering, stem sells, reproductive technologies, biodiversity, new materials (e.g. graphene), life cycle assessment, and nanotechnology are more likely to be of implemented in the classrooms,*** as these areas are evident in the curriculum of the country.

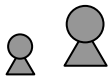
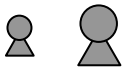
- ***For age group 11-14, resources relating to the nature of science are more likely to be implemented in the classrooms*** due to the fact that they such content is evident and/or prioritized in the curriculum of the country.

- Themes relating to socio-scientific issues, technology, values, nature of science are evident but not prioritized both in in-service and pre-service teacher training, indicating ***that teachers' content background on the area might be limited.*** ENGAGE workshops and online courses on teacher training of RRI materials may prove particularly helpful in this regard.

4. 1.4. Pedagogical processes and RRI - UK

The tables below show whether or not pedagogical strategies such as IBL and argumentation (that relate to RRI objectives) are evident and prioritized in the country.

Inquiry-Based Learning	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

Argumentation	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

 **Students 11-14 years old**

 **Pre-service teachers**

 **Students 14-16 years old**

 **In-Service teachers**

As shown in the first table above, inquiry-based leaning is evident in the curriculum and frequently implemented in the classrooms for age groups targeted by the project. In addition, it is a part of teacher training programs both in-service and pre-service. As reported by the UK partners, there is much investigative work at the area of inquiry based

pedagogies in terms of actual implementation in the classrooms, in the sense of developing a skill-set in scientific practices. In contrast, the second table indicates that although students are given opportunities to practice argumentation, making argument explicit and teaching the skills is not frequently implemented in the classrooms, maybe because of time constrains. Yet, it should be noted that teachers are familiarized with teaching through argumentation methodologies, as it is a part of teacher training programmes.

Probable implications to the project:

- There is ***a fruitful educational context*** in the country for the aims of the ENGAGE project ***in terms of familiarization of teachers with inquiry based learning and actual implementation of the pedagogy in*** the classrooms.

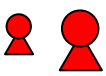
- In contrast***, argumentation*** is not frequently implemented in the classrooms for all age groups. In case ***time constrains*** is a reason for not frequent use of argumentation methodologies in the classrooms, it ***should be taken into account for the development of guidelines for using the resources in the classroom*** - maybe the principle "less is more" in the development of the resources, would allow time for students to engage in argumentative discourse.

4. 1.5. Context (informal settings, society) and RRI - UK

In this section, we seek to gain an understanding on the degree to which there are connections between schools and informal setting with an aim to support RRI objectives, as well as on the degree on which the broader societal communities – in which students are active members- are aware of and support RRI initiatives. Information provided aims to facilitate dissemination work and the process of engaging informal educational providers in the project in the country

Actors that promote RRI initiatives	***Examples on how RRI initiatives are promoted***
Curriculum projects such as ENGAGE from various universities, Professional bodies (royal society of chemistry, institute of physics, institute of biology), The British Science Association, Scientific Research Councils (RCUK), Science Learning Centre Network, Association for Science Education.	Materials, courses
Professional bodies (see above list)	As above
Science centres/museums (e.g. National Science Museum, At Bristol, Thinktank, Centre for Life)	Events, courses

Actors that implement RRI initiatives	**Implementation as part of …**			
	…the national strategy	…school mission	…teaching strategy	Other (please explain)
Same as above table	X			
Same as above table			X	

Connections between schools and informal education providers			
	Not Evident	***Evident but not prioritized***	***Evident and prioritized***

 **Primary schools**

 **General secondary schools**  **Vocational Schools**

4. 1.6. Probable barriers and opportunities to the project - UK

In the light of the analysis of the science curriculum in UK that was presented in the previous sections, the following issues that emerge might have implications in various levels within the ENGAGE project:

Probable Barriers:

- There is much policy change in UK at the time across school systems, structures and governance, curriculum and qualifications, initial teacher and continuing teacher education; with ***change across all areas at the same time the challenge for the ENGAGE project is potentially significant***.
- Recent curriculum changes indicate that content-base objectives are rather more prioritized in the country in comparison to objectives that are more RRI oriented (for example the acquisition of values); this might be ***a hindering factor need to be taken into consideration in the process of engaging big numbers of sciences teachers in implementing in the classrooms resources that relate to RRI objectives.***
- RRI aspects seem to be ***inadequately assessed in formal assessment the country; this might be a barrier*** for the accomplishment of the project's objectives***. Specific assessment guidelines to the teachers*** would benefit the broader uptake of the project's recourses and materials.
- Themes relating to RRI teaching are evident but not prioritized both in in-service and pre-service teacher training, indicating ***that teachers' content background on the area might be limited.*** ENGAGE workshops and online courses on teacher training of RRI materials may prove particularly helpful in this regard.
- ***Argumentation*** is not frequently implemented in the classrooms for all age groups, maybe because of ***time constrains***. This ***should be taken into account for the development of guidelines for using the resources in the classroom*** - maybe the principle "less is more" in the development of the resources, would allow time for students to engage in argumentative discourse.

Probable Opportunities:

- Recent curriculum changes have not yet reached classroom practice, but rather remain at the level of policy rhetoric; it is not only a challenge but also an ***opportunity for ENGAGE to have an actual impact in the country, by facilitating the transformation of policy envisions to classroom implementation***.
- Curriculum objectives are partly in line with RRI for Key Stage 3 and in line with RRI for Key Stage 4; however due to external assessment, ***it might less challenging to engage key Stage 3 teachers in RRI teaching than Key Stage 4 teachers***.

- In terms of content, for ***age group 12-16***, ***resources relating to genomics, genetic engineering, stem sells, reproductive technologies, biodiversity, new materials (e.g. graphene), life cycle assessment, and nanotechnology are more likely to be of implemented in the classrooms,*** as these areas are evident in the curriculum of the country. ***For age group 11-14, resources relating to the nature of science are more likely to be implemented in the classrooms*** due to the fact that they such content is evident and/or prioritized in the curriculum of the country.
- There is ***a fruitful educational context*** in the country for the aims of the ENGAGE project ***in terms of familiarization of teachers with inquiry based learning and actual implementation of the pedagogy in*** the classrooms.

References

National Curriculum for England, 2014 (UK Government)
https://www.gov.uk/government/collections/national-curriculum

Science upd8 project (Sheffield Hallam University/Association for Science Education)

www.upd8.org.uk

Framework for Responsible Innovation (EPSRC)

http://www.epsrc.ac.uk/research/framework/Pages/framework.aspx

4.2. RRI Curriculum Analysis for the case of Greece

4.2.0. Background – Greece

The Greek educational system has traditionally maintained a centralized character. Decisions are made in practice from the Ministry of Education that is consulted by an organization called Institute of Educational Policy (IEP). In this context, the goals and framework for the education sector are defined by the IEP and the Government (Ministry of Education).

There is a national curriculum accompanied by a single textbook determined by the IEP for each school subject and grade, including science. Reforms are mainly perceived as changes of the curriculum occasionally accompanied by short in-service seminars for teachers.

The Greek educational system has the following general levels: Primary Education (Pre-primary & primary education, 3-5 and 6-12 years old accordingly); Secondary Education (Gymnasium & Lyceum, 12-15 and 15-18 years old accordingly); Higher Education (Higher & Tertiary Education).

In relation to science education and the way it is taught for each age group, for students age 11-12 (upper elementary science) it is mainly interdisciplinary, with an emphasis on topics from physics, biology and environmental education); for age 13-15 (middle school) it is mainly disciplinary (physics, chemistry, biology); similarly for age 15-16 (high-school) science is mainly disciplinary (i.e. biology, chemistry, or physics).

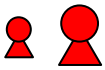
Probable implications to the project:

- The ***highly centralized educational system may not allow much autonomy for teachers to implement additional to textbooks materials in the classrooms***, an issue that should be taken into consideration in the preparation of the dissemination plan for the country.

- The way science is taught in the country should be taken into consideration ***In the process of localization and dissemination*** of the project's curriculum materials/recourses. For ***age group 11-12, resources dealing with multidisciplinary issues*** might be more relevant to the educational context; ***for age group 13-16 materials with content addressing a specific discipline*** should be preferred to resources in multidisciplinary format.

4.2. 1. Recent curriculum changes in relation to RRI – Greece

The table below provides an indication on the degree to which aspects of RRI philosophy are (or are not) emerging in current or envisioned educational changes –-where evident - both in policy and in educational practice.

Changes relating to	***…the envisioned curriculum***				
	…the enacted curriculum				
	….teacher training				
		No change	***Not in line with RRI***	***Partly in line with RRI***	***In line with RRI***

 **Students 11-15 years old**

 **Students 15-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

As evident in table above, curriculum changes in the country are mainly evident for compulsory education (primary and secondary level) while in the last year reforms targeted students age 15-16. The reform (called New School) is currently at the stage of piloting phase in a number of schools in a country. Some aspects of the reform –that indicate that it is partly in line with RRI framework – are an emphasis that is put on the connection of science with everyday life and on teachers using interactive pedagogies. In terms of teacher training, teachers' active engagement in new forms of didactical design and implementation is highly prioritized. Focus is also put on teachers' active engagement in selection of teaching resources and materials and in particular the exploitation of digital technologies for adding pedagogical value. Changes are also evident in terms of teachers' evaluation: one of the proposed changes in the evaluation will account for teachers' participation in professional development. Policy envisions are gradually being implemented in the classrooms, mainly for age groups 11-15 years old students. In contrast, a new form of assessment that has been introduced this year for students 15-16 years olds – which is highly knowledge based- has lead to an enacted curriculum in the country which is not in line with RRI objectives.

Probable implications to the project:

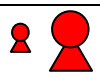
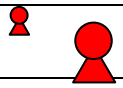
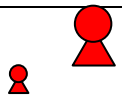
- Reforms in science education are currently at the level of piloting and are partly in line with RRI framework, especially for ***students' age 11-15*** and provide ***a rather fruitful context for the accomplishment of the project's objectives***.

- A new form of assessment that has been recently introduced for students 15-16 years olds – which is highly knowledge based- has lead to an enacted curriculum in the country which is not in line with RRI objectives. As such ***primary and lower secondary teachers should be the main target group in the country.***

- Changes in the way teachers are evaluated account for teachers' participation in professional development. This is an ***opportunity for ENGAGE to impact teachers professional development in the country***.

4.2.2. Curriculum objectives and expected outcomes in relation to RRI –Greece

The table below illustrates the prioritized objectives that are evident in the curriculum and in the formal assessment in the country.

Objectives and outcomes prioritized					
	Acquisition of scientific knowledge	*Policy documents*			
		Formal assessment			
	Development of scientific skills	*Policy documents*			
		Formal assessment			
	Acquisition of Values	*Policy documents*			
		Formal assessment			
			Not a priority	***Medium Priority***	***High Priority***

 Students 11-15 years old  **Students 15-16 years old**

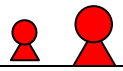
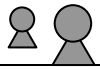
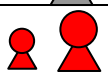
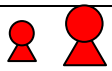
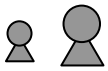
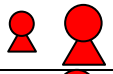
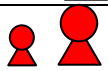
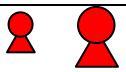
In terms science curriculum objectives as evident in curriculum documents highly prioritized are objectives that relate to the acquisition of content knowledge and the development of scientific skills. Objectives relating more to RRI thematic such as the acquisition of values are of medium priority for students 11-15 years old, while they are not prioritized at upper secondary level. In terms of assessment, prioritized objectives are mainly on the acquisition of content knowledge.

. ***Probable implications to the project:***

➢ ***Assessment goals*** receive more attention by teachers in the country than policy rhetoric – and these ***are mainly knowledge based***. This might be a ***hindering factor*** in the process of engaging many science teachers implementing the project's materials in the classroom.

11.3. Curriculum Content and RRI (socio-scientific issues, technology, values, nature of science) – Greece

This section aims to provide an understanding on whether or not (and up to what degree) themes relating to socio-scientific issues, technology, values, nature of science are evident and prioritized in the curriculum of the country.

Curriculum content in the areas of			*Not Evident*	*Evident but not prioritized*	*Evident and prioritized*
	…socio-scientific issues	Curriculum			
		Assesment			
		Teacher training			
	…technology	Curriculum			
		Assesment			
		Teacher training			
	… values	Curriculum			
		Assesment			
		Teacher training			
	…nature of science	Curriculum			
		Assesment			
		Teacher Training			

 **Students 11-15 years old**

 **Students 15-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

As evident in the table above themes relating to RRI content are manly not evident in the country's curriculum and in exams. In terms of teacher training, content on RRI thematic is more evident in pre-service teacher training (especially in primary education) than in teachers professional development.

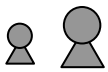
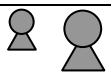
Probable implications to the project:

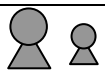
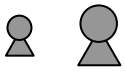
- ***Content relating to RRI teaching is mainly not evident in the science curriculum.*** This might be a ***hindering factor*** for engaging big numbers of science teachers to implement ENGAGE RRI materials in the classrooms, especially if there is not much autonomy for teachers in the country to implement extra curriculum activities.

- ***In the process of localization and dissemination*** of the project recourses, materials ***associated with socio-scientific issues and technology should be preferred*** as they seem to be more relevant and associated with the science curriculum content in the country.

4.2.4. Pedagogical processes and RRI

The tables below show whether or not pedagogical strategies such as IBL and argumentation (that relate to RRI objectives) are evident and prioritized in the country.

Inquiry-Based Learning	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

Argumentation	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

 **Students 11-15 years old**

 **Pre-service teachers**

 **Students 15-16 years old**

 **In-Service teachers**

Inquiry based learning is evident in science curriculum and prioritized mainly for age groups 11-15 years old. In addition, teachers training programmes in the country currently mainly focus on this pedagogy. In contrast argumentation is neither evident in the curriculum, nor be a part of teachers' training. Nevertheless, both methodologies are not frequently been

implemented in the classrooms – only by highly motivated and innovative teachers – mainly because of curriculum overload and the type of assessment.

Probable implications to the project:

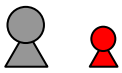
- Teachers do not seem to be familiar with the notion of argumentation. ***Specific guidelines on implementing argumentation would particularly benefit the accomplishment of the aims of the project in the country***.
- Both ***inquiry based learning*** and ***argumentation are*** not frequently implemented in the classrooms for all age groups. In case ***time constrains*** is a reason for not frequent use of RRI methodologies in the classrooms – as in other countries-, it ***should be taken into account for the development of guidelines for using the resources in the classroom*** - maybe the principle "less is more" in the development of the resources, would allow time for students to engage in argumentative discourse and inquiry.

4.2.5. Context (informal settings, society) and RRI

In this section, we seek to gain an understanding on the degree to which there are connections between schools and informal setting with an aim to support RRI objectives, as well as on the degree on which the broader societal communities – in which students are active members- are aware of and support RRI initiatives. Information provided aims to facilitate dissemination work and the process of engaging informal educational providers in the project in the country.

Actors that promote RRI initiatives	Examples on how RRI initiatives are promoted
Evgenidio Institute	Events, conferences, press
FORTH	Events like "researchers' day"
Institute of Educational Policy	Events, conferences, press
Network PRAXIS	Workshops, conferences

Actors that implement RRI initiatives	Implementation as part of …			
	…the national strategy	…school mission	…teaching strategy	Other (please explain)
Evgenidio Institute	X			
Science museums (like museum of natural history Crere)	X	X		
Institute of Educational Policy	X			
Science Clubs			X	

Connections between schools and informal education providers			
	Not Evident	***Evident but not prioritized***	***Evident and prioritized***

 **Primary schools**

 **General secondary schools**

 **Vocational Schools**

4.2.6. Probable barriers and opportunities to the project

In the light of the analysis of the science curriculum in Cyprus that was presented in the previous sections, the following issues that emerge might have implications in various levels within the ENGAGE project:

Probable Barriers:

- The ***highly centralized educational system may not allow much autonomy for teachers to implement additional to textbooks materials in the classrooms***, an issue that should be taken into consideration in the preparation of the dissemination plan for the country.

- ***Assessment goals*** receive more attention by teachers in the country than policy rhetoric – and these ***are mainly knowledge based***. This might be a ***hindering factor*** in the process of engaging many science teachers implementing the project's materials in the classroom.

- ***Content relating to RRI teaching is mainly not evident in the science curriculum.*** This might be a ***hindering factor*** for engaging big numbers of science teachers to implement ENGAGE RRI materials in the classrooms, especially if there is not much autonomy for teachers in the country to implement extra curriculum activities.

- Teachers do not seem to be familiar with the notion of argumentation. ***Specific guidelines on implementing argumentation would particularly benefit the accomplishment of the aims of the project in the country***.

- Both ***inquiry based learning*** and ***argumentation are*** not frequently implemented in the classrooms for all age groups. In case ***time constrains*** is a reason for not frequent use of RRI methodologies in the classrooms – as in other countries-, it ***should be taken into account for the development of guidelines for using the resources in the classroom*** - maybe the principle "less is more" in the development of the resources, would allow time for students to engage in argumentative discourse and inquiry.

Probable Opportunities:

- The way science is taught in the country should be taken into consideration ***In the process of localization and dissemination*** of the project's curriculum materials/recourses. For ***age group 11-12, resources dealing with multidisciplinary issues*** might be more relevant to the educational context; ***for age group 13-16 materials with content addressing a specific discipline*** should be preferred to resources in multidisciplinary format.

- Reforms in science education are currently at the level of piloting and are partly in line with RRI framework, especially for ***students' age 11-15*** and provide ***a rather fruitful context for the accomplishment of the project's objectives***.

- A new form of assessment that has been recently introduced for students 15-16 years olds – which is highly knowledge based- has lead to an enacted curriculum in the country which is not in line with RRI objectives. As such ***primary and lower secondary teachers should be the main target group in the country.***

- Changes in the way teachers are evaluated account for teachers' participation in professional development. This is an ***opportunity for ENGAGE to impact teachers professional development in the country***.

- ***In the process of localization and dissemination*** of the project recourses, materials ***associated with socio-scientific issues and technology should be preferred*** as they seem to be more relevant and associated with the science curriculum content in the country.

References

http://photodentro.edu.gr/lor/?locale=en

http://www.iep.edu.gr/services/regexp/

http://www.minedu.gov.gr/

4.3. RRI Curriculum Analysis for the case of Germany

4. 3.0. Background – Germany

Germany is consisting of 16 constituent states – these units of the federation are called "Länder" (singular: Land). Education structures and policy are determined by the federal structure of the Federal Republic of Germany and most responsibilities for the education system remain with the single Länder. Accordingly, despite sharing common features, there are 16 slightly different school systems.

The education system in Germany is very complex due to the federal organization
The most important specificities are the following: a) the start of compulsory education for all children at the age of six years and lasting for at least nine years – depending on the school type; b) a differentiation of lower secondary education that selects students into different tracks leading to qualifications with different status, including a strong stand of special school; that is, the end of primary education is marked by a highly selective transition to a four types of secondary schools; c) at the age of 15, pupils complete compulsory education and move on to upper secondary education (ages 11-15: Secondary Level I; ages 15-16: Secondary Level II).

Given the complexity of the educational system in Germany, this report focuses on the "Land" Bavaria. Partners of Germany have checked it cross with the other "Lander" and additionally they verified content with an expert on the field.

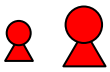
In relation to science education and how it is taught, for student age 11-12 science is mainly disciplinary, e.g. biology; for the age group 13-15 mainly disciplinary, e.g. biology, social science, physics, chemistry; and for age 15-16 science is mainly taught as disciplinary, but also in parts interdisciplinary and multidisciplinary, (e.g. biology, social science, physics, chemistry).

Probable implications to the project:

- The fact that science is taught mainly in a disciplinary manner should be taken into account ***in the process of localization and dissemination*** of the curriculum materials/recourses – in this case materials with content more relevant to each discipline should be preferred to resources in multidisciplinary format, especially for age group 13-15 years old.

4.3.1. Recent curriculum changes in relation to RRI – Germany

The table below provides an indication on the degree to which aspects of RRI philosophy are (or are not) emerging in current or envisioned educational changes –-if evident - both in policy and in educational practice.

Changes relating to	***…the envisioned curriculum***				
	…the enacted curriculum				
	….teacher training				
		No change	***Not in line with RRI***	***Partly in line with RRI***	***In line with RRI***

 **Students 11-14 years old**

 **Students 14-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

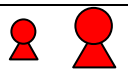
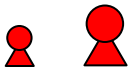
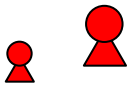
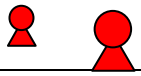
No significant changes have been recently taken place in the country, either in the envisioned, the enacted curriculum or in terms of teacher training. National education standards that have been introduced in 2003/2004 and for each of the school type/level – and due to the federal structure, for each Land – specific standards have been formulated. The national standards agreed upon at federal level encompass 6 general competencies: problem-solving, reasoning, communicating, using mathematical/natural science representations, dealing with symbolic, formal and technical elements of mathematics/natural sciences. Four areas of competences in the natural sciences were agreed on: specialized knowledge of the subject, gaining realization, communication and assessment. Standards are assigned to each field. The standards of gaining realization refer to scientific working methods that are used to gain new insights within this science. The introduction of national education standards and performance testing has inserted brought with it – at least in theory – some flexibility in terms of teaching methods and task types/structures to be used in classroom.

Probable implications to the project:

- ***The increased autonomy of teachers and the relevant flexibility in terms of teaching methods offers the possibility for the introduction of RRI materials in the classroom,*** as teachers now have the option to use different methods and tasks, as long as the core themes and levels of the respective subject are respected.

4. 3.2. Curriculum objectives and expected outcomes in relation to RRI – Germany

The table below illustrates the prioritized objectives in the curriculum and in the formal assessment in the country.

Objectives and outcomes prioritized	***Acquisition of scientific knowledge***	*Policy documents*			
		Formal assessment			
	Development of scientific skills	*Policy documents*			
		Formal assessment			
	Acquisition of Values	*Policy documents*			
		Formal assessment			
			Not a priority	***Medium Priority***	***High Priority***

 **Students 11-13 years old**  **Students 13-16 years old**

For both age groups science curriculum is mainly oriented towards the acquisition of scientific knowledge (evident both in policy rhetoric and on what is actually assessed in students' formal assessment) and to a lesser degree on the development of scientific skills and the acquisition of values. Critical thinking and decision making is foreseen but not so much supported the way formal assessment takes place. This might be an obstacle in the degree to which teachers in the country will be engaged with the materials and actually introduce them in the classrooms, as the prioritized objectives are partly in line will RRI curriculum. Careful strategic dissemination plan and promoting materials that elaborate on RRI principles and how the engagement with the materials have the potential of offering deep conceptual knowledge is needed.

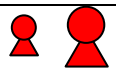
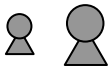
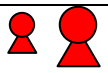
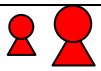
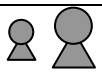
Probable implications to the project:

- The fact that content-base objectives are rather more prioritized in the country in comparison to objectives that are more RRI oriented may be ***a hindering factor in***

the process of engaging many sciences teachers in implementing the resources, especially those teaching age groups that are more close to final exams for entering higher education. ***The importance of addressing RRI aims in science teaching should be made explicit both during the workshops and the online courses.***

4. 3. 3. Curriculum Content and RRI (socio-scientific issues, technology, values, nature of science) – Germany

This section aims to provide an understanding on whether or not (and up to what degree) themes relating to socio-scientific issues, technology, values, nature of science are evident and prioritized in the curriculum of the country.

Curriculum content in the areas of	***…socio-scientific issues***	Curriculum			
		Assesment			
		Teacher training			
	…technology	Curriculum			
		Assesment			
		Teacher training			
	… values	Curriculum			
		Assesment			
		Teacher training			
	…nature of science	Curriculum			
		Assesment			
		Teacher Training			
			Not Evident	***Evident but not prioritized***	***Evident and prioritized***

 **Students 11-14 years old**

 **Students 14-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

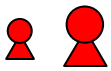
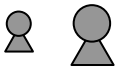
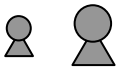
As reported by the German partners, curriculum content relating to RRI in the envisioned curriculum and the formal assessment for both age groups might be evident in the country but not prioritized. Thematic areas of interests for students between 11 and 14 could be: reasons and effects of waste of food, benefits and risks of antibiotic use; thematic areas for students between 14 -16 years could be: historic and actual conflicts (acts of war, embargoes, effects of financial affairs and contracts, reasons and effects of subsides), exit from nuclear and fossil-fuel energy, intercultural effects/reasons and effects of migration and migration policies, reasons and effects of climate change, possibilities and risks of prenatal diagnosis. According the age of the pupils the complexity of the presented material needs to be adapted. In addition, RRI related issues are evident but not prioritized in in-service and pre-service teacher training, indicating that teachers in the workshops would benefit with background information on RRI thematic orientation and its value for better engagement and implementation in the classroom.

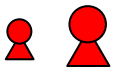
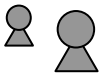
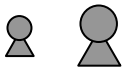
Probable implications to the project:

- For all age groups, issues relating to technology socio-scientific issues, values and nature of science may be evident but ***not prioritized both in the curriculum and in teacher training***. It is ***a challenge*** for the project ***to engage teachers in the country in implementing in the classroom recourses in thematic areas that are not prioritized by the official curriculum.***

4. 3. 4. Pedagogical processes and RRI – Germany

One aspect of the curriculum has to do with the pedagogical processes that are proposed in the curriculum and that are actually implemented in the classrooms. The tables below show whether or not pedagogical strategies such as IBL and argumentation (that relate to RRI objectives) are evident and prioritized in the country.

Inquiry-Based Learning	*…the envisioned Curriculum*			
	….teacher Training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

Argumentation	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

 **Students 11-14 years old**

 **Students 14-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

In Germany teaching methodologies may be evident in the curriculum and in teacher training, but they are not frequently been implemented in the classrooms. Indeed, as evident in the first table above, teachers seem to be acquainted with inquiry based learning in the country, given that questioning teaching methods are supported and proposed in the envisioned curriculum and introduced in teacher training programmes. However -as it has been reported in many studies relating to inquiry based methods across Europe - such a methodology is not frequently implemented in the classrooms. Time constrains as well as the lack of appropriate pedagogical materials have been reported as the main reasons why inquiry based learning is not the main choice for teaching. On the other hand, although students are given opportunities to practice argumentation, making argument explicit and teaching the skills is not frequently implemented in the classrooms. The main issue here is the lack of supportive materials on how teachers should engage students in a fruitful argumentative discourse.

Probable implications to the project:

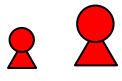
- Although teachers seem to be familiarized with RRI teaching methodologies such as inquiry based learning and argumentation, they do not frequently implement them in the classrooms. ***The challenge for the ENGAGE project is to provide teachers with guidelines for easy implementation of the materials, with the aid of pedagogies that can be used with flexibility within the limited time-frames in classroom implementation.***

4. 3.5. Context (informal settings, society) and RRI –Germany

In this section, we seek to gain an understanding on the degree to which there are connections between schools and informal setting with an aim to support RRI objectives, as well as on the degree on which the broader societal communities – in which students are active members- are aware of and support RRI initiatives. Information provided aims to facilitate dissemination work and the process of engaging informal educational providers in the project in the country.

Actors that promote RRI initiatives	Examples on how RRI initiatives are promoted
Staatsinstitut für Schulqualität und Bildungsforschung http://www.lehrplanplus.bayern.de/ http://www.kompas.bayern.de/	• Europaportal - Demokratieerziehung an Schulen in Bayern • Nachhaltige Entwicklung - Schule und globale Entwicklung • Werteerziehung und soziales Lernen • Kompetenzorientierung und LehrplanPLUS
Stiftung Bildungspaket Bayern http://www.bildungspakt-bayern.de/startseite/	• Denkfabrik, Kreativwerkstatt und Innovationsmotor
Bayerischer Schulserver http://www.schule.bayern.de/unterricht	• Materials
https://www.mebis.bayern.de/	• Materials

Actors that implement RRI initiatives	Implementation as part of …			
	…the national strategy	…school mission	…teaching strategy	Other (please explain)
Stiftung Bildungspaket Bayern http://www.bildungspakt-bayern.de/startseite/		• materials • projects	• materials • projects	
Bayerischer Schulserver http://www.schule.bayern.de/unterricht		• materials • projects	• materials • projects	
Landesmedienzentrum Bayern https://www.mebis.bayern.de/				

Connections between schools and informal education providers			
	Not Evident	***Evident but not prioritized***	***Evident and prioritized***

 **Primary schools**

 **General secondary schools**

 **Vocational Schools**

4.3.6. Probable barriers and opportunities to the project

In the light of the curriculum analysis in Germany that was presented in the previous sections, the following issues emerge that might have implications for various levels within the ENGAGE project:

Probable Barriers:

- The fact that content-base objectives are rather more prioritized in the country in comparison to objectives that are more RRI oriented may be ***a hindering factor in the process of engaging many sciences teachers in implementing the resources,*** especially those teaching age groups that are more close to final exams for entering higher education. ***The importance of addressing RRI aims in science teaching should be made explicit both during the workshops and the online courses.***

- For all age groups, issues relating to technology socio-scientific issues, values and nature of science may be evident but ***not prioritized both in the curriculum and in teacher training***. It is ***a challenge*** for the project ***to engage teachers in the country in implementing in the classroom recourses in thematic areas that are not prioritized by the official curriculum.***

- RRI teaching methodologies such as inquiry based learning and argumentation, are not frequently being implemented in the classrooms mainly because of time constrains and lack of appropriate materials. ***The challenge for the ENGAGE project is to provide teachers with guidelines for easy implementation of the materials, with the aid of pedagogies that can be used with flexibility within the limited time-frames in classroom implementation.***

Probable Opportunities:

- The fact that science is taught mainly in a disciplinary manner should be taken into account ***in the process of localization and dissemination*** of the curriculum materials/recourses – in this case materials with content more relevant to each discipline should be preferred to resources in multidisciplinary format, especially for age group 13-15 years old.

- The project should built on the fact that ***science teachers in the country seem to be familiarized with RRI teaching methodologies*** such as inquiry based learning and argumentation.

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http://www.km.bayern.de/
http://www.bildungsserver.de/Kultusministerien-580.html
http://www.bmbf.de/
http://www.schulentwicklung.bayern.de/
https://www.iqb.hu-berlin.de/
https://www.sbg.ac.at/erz/salzburger_beitraege/herbst%202002/astl_202.pdf
http://www.ehow.de/fordere-schulern-kritisches-denken-info_7057/
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4.4. RRI Curriculum Analysis for the case of France

4.0. Background - France

The French educational system is highly centralized and organized. It is divided into three stages: Primary education, 6-10 years old (*enseignement primaire*); Secondary education, 11-14 years old (college - *enseignement secondaire*); Higher education (lycée*)* 15-18 years old. Both collège (Lower Secondary school) and lycée (Upper Secondary school) are part of «enseignement secondaire».

In terms of science education, for students aged 11-12 (secondary school) science is mainly disciplinary (biology/geology), plus 3 to 4 hours per week of integrated science and technology education. The integrated science and technology education is a three disciplines teaching: Life Sciences and Earth, physics, chemistry and technology. It promotes disciplinary de-compartmentalization and it offers students the opportunity to carry out an investigative approach, which is a major characteristic of science education. This teaching is experimental and it covers a limited number of secondary schools. For age group 12-15 (secondary school) science is mainly disciplinary (biology/geology, chemistry/physics). For age 15-16 (high school) it is mainly disciplinary (biology/geology, chemistry/physics) with an addition of two "exploration courses" (biotechnology, science and laboratory, health and social development and technological innovation, engineering sciences...) of 1h30 per week each. Finally, at the age of 16, science education varies according to the student major (science, literature, economy…).

Probable implications to the project:

- ***In the process of localization and dissemination*** of the project's curriculum materials/recourses, the way science is taught in the country should be taken into consideration. For ***age group 11-12, resources dealing with multidisciplinary issues*** might be more relevant to the educational context; ***for age group 12-16 materials with content addressing a specific discipline*** should be preferred to resources in multidisciplinary format.

- ***Teachers involved in the courses of integrated science and technology education for age group 11-12*** and ***'exploration courses' for age groups 12-15 should be specifically targeted for being involved*** in the project, as many of the recourses being developed are highly relevant to the content of their teaching.

4. 4.1. Recent curriculum changes in relation to RRI – France

The table below provides an indication on the degree to which aspects of RRI philosophy are (or are not) emerging in current or envisioned educational changes both in policy and in educational practice.

Changes relating to					
	…the envisioned curriculum				
	…the enacted curriculum				
	….teacher training				
		No change	***Not in line with RRI***	***Partly in line with RRI***	***In line with RRI***

 **Students 11-13 years old**

 **Pre-service teachers**

 **Students 13-16 years old**

 **In-Service teachers**

As reported by the French partners, in relation to the envisioned curriculum, since 2013, Education for sustainable development has been included in the curriculum. The aim is to help to understand the complexity of the world in its scientific ethical and civic dimensions. Multidisciplinary has been integrated into the functioning of institutions and the teachers and supervisors training. In relation to the enacted curriculum, there seems to be a rather fruitful context for the aims of the ENGAGE project in the country for the age group 11-13. The integrated science and technology education (EIST) has been experimented since 2006 and it is now implemented in more schools. Its approach is based on scientific investigation and technological practices and promotes the removal of barriers between disciplines. In contrast, for the age group 13-16 the changes in terms of the enacted curriculum are not in line with RRI philosophy –despite policy envisions – indicating a hindering factor for the accomplishment of the aims of the project.

In terms of teacher training, and for pre-service teachers, there aren't any aspects of RRI. The last reform has resulted in: the creation of the Higher Schools of Teaching and Education (ESPE) on September 2013; the establishment of new Masters "Teaching, Education and Training Professions" (MEEF); the introduction of new teachers recruitment formats. For in-service teachers, in 2013, 4 prototypes "Regional house of science" (8 in September 2014) were created. The objective is to help teachers to develop their science teaching practices. Each house offers, across its region, professional development to science and technology teachers from kindergarten to secondary school. At the heart of this project is the desire to allow teachers to build or strengthen relationships with current science and technology,

attractive, rooted in history. To bring together the educational community of the scientific world, the Houses of Science are located in major universities.

Probable implications to the project:

- Current changes in the science envisioned curriculum indicate that RRI aspects are evident and prioritized in policy declarations. Especially for ***age group 11-13 years old***, changes on policy envisions have been passed to the classroom level of actual implementation, providing ***a fruitful context for the accomplishment of the project goals in terms of prioritized objectives.***

- For ***the age group 13-16***, the fact that recent changes in terms of RRI objectives have not yet reached classroom practice uncover ***a challenge and an opportunity for ENGAGE to have an actual impact in the country, by facilitating the transformation of policy envisions to classroom implementation.***

4.4.2. Curriculum objectives and expected outcomes in relation to RRI-France

The table below illustrates the prioritized objectives in the curriculum and in the formal assessment in the country.

Objectives and outcomes prioritized	***Acquisition of scientific knowledge***	*Policy documents*			1, 2, 3, 4, 5
		Formal assessment			1, 2, 3, 4, 5
	Development of scientific skills	*Policy documents*	1	2, 3,	4, 5
		Formal assessment		1,2, 3	4,5
	Acquisition of Values	*Policy documents*		1,2,3,4,5,	
		Formal assessment		1,2,3,4,5	
	Develop curiosity, creativity, critical thinking and interest in the scientific and technical progress	*Policy documents*		3,4,5,	1,2,
		Formal assessment		4, 5	1,2, 3,
	Prepare and support scientific career	*Policy documents*	1,2,3		4,5
		Formal assessment		1,2,3,4,5	
			Not a priority	***Medium Priority***	***High Priority***

(1) Students 11-12 years old (2) Students 12-13 years old (3) Students 13-14 years old

(4) Students 14-15 years old (5) Students 15-16 years old

In total, as reported by the French partners, the prioritized objectives in the envisioned curriculum seem to be partly in line with RRI philosophy for students 11-16 years old; however it should be noted that a great variation is reported for each age group in terms of curriculum objectives, indicating that in this country, resources should target specific grades, rather than education level (primary, secondary, higher) if best dissemination outcomes are to be achieved. Despite this variation, as evident in the table above, for all age groups objectives relating to the acquisition of scientific knowledge seem to be of high priority in science teaching for all age groups. This is also the case as far as the expected learning outcomes that are assessed in the countries' formal assessment are concerned. In addition, objectives relating to RRI philosophy (for example the acquisition of values and the development of curiosity, creativity, critical thinking and interest in the scientific and technical progress) are evident in the science curriculum but of medium priority for most age groups.

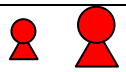
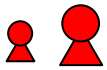
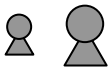
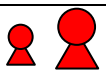
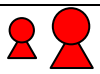
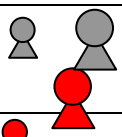
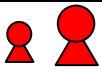
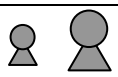
Probable implications to the project:

- A great variation in terms of prioritised curriculum objectives is evident at each grade in the country; it might be wise that ***the project resources localized for this country target specific student ages, rather than education levels*** (primary, secondary, higher) ***if best dissemination outcomes are to be achieved.***

- Similar to other countries involved in this study, content-base objectives are rather more prioritized in the country in comparison to objectives that are more RRI oriented. This may be ***a hindering factor in the process of engaging many sciences teachers in implementing the resources,*** especially those teaching age groups that are more close to final exams for entering higher education. ***The importance of addressing RRI aims in science teaching should be made explicit both during the workshops and the online courses.***

4.4.3. Curriculum Content and RRI (socio-scientific issues, technology, values, nature of science) – France

This section aims to provide an understanding on whether or not (and up to what degree) themes relating to socio-scientific issues, technology, values, nature of science are evident and prioritized in the curriculum of the country.

Curriculum content in the areas of			*Not Evident*	*Evident but not prioritized*	*Evident and prioritized*
	…socio-scientific issues	Curriculum			
		Assesment			
		Teacher training			
	…technology	Curriculum			
		Assesment			
		Teacher training			
	… values	Curriculum			
		Assesment			
		Teacher training			
	…nature of science	Curriculum			
		Assesment			
		Teacher Training			

 **Students 11-12 years old**

 **Students 13-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

As reported by the French partners, content relating to RRI teaching is mainly not evident in the science curriculum. Exceptions to this general picture are the following: for age 11-12

years old, themes on technology seem to be evident and prioritized in the curriculum (EIST teaching , Life Sciences and Earth, physics, chemistry) and are also evident in formal assessment, especially in chemistry (for example : WATER IN OUR ENVIRONMENT: What role does water play in our environment and in our food?); for age group 12-13 years old relevant to RRI thematic is COMPOSITION OF THE AIR (what comprises the air we breathe? Is it a pure substance? Link with Sustainable development and health); for age group 13-16 years old issues relating to values are evident and prioritized in the curriculum (yet they are not evident in students assessment).

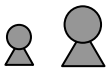
Probable implications to the project:

- The general picture of the science curriculum shows that ***content relating to RRI teaching is mainly not evident in the science curriculum.*** This might be a hindering factor for engaging big numbers of science teachers to implement ENGAGE RRI materials in the classrooms.

- In terms of content, ***for age group 11-12***, ***resources relating to technology are more likely to be of implemented in the classrooms,*** as they are more evident in the curriculum and in formal assessment.
- ***For age group 13-15, resources relating to values are more likely to be implemented in the classrooms*** due to the fact that they such content is evident and/or prioritized in the curriculum of the country – yet the theme is not evident in formal assessment.

4.4. 4. Pedagogical processes and RRI – France

One aspect of the curriculum has to do with the pedagogical processes that are proposed in the curriculum and that are actually implemented in the classrooms. The tables below show whether or not pedagogical strategies such as IBL and argumentation (that relate to RRI objectives) are evident and prioritized in the country.

Inquiry-Based Learning	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

Argumentation	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

 **Students 11-13 years old**

 **Pre-service teachers**

 **Students 13-16 years old**

 **In-Service teachers**

As evident in the first table above, inquiry-based leaning is evident in the curriculum and frequently implemented in the classrooms for age group 11-13. Yet, it is not a part of teacher training programs both in-service and pre-service. In addition argumentation is neither evident in teacher training, nor frequently implemented in the classrooms for all age

groups. As reported by the French partners, although students are given opportunities to practice argumentation, making argument explicit and teaching the skills is not frequently implemented in the classrooms. Specific guidelines on how teachers could deal with RRI themes in the classroom engaging students in argumentative discourse and inquiry based learning would particularly benefit the accomplishment of the aims of the project in the country.

Probable implications to the project:

- There is ***a more fruitful educational context*** in the country for the aims of the ENGAGE project ***in terms actual implementation of inquiry based pedagogy in*** the classrooms ***for students ages 11-13*** than 13-16.
- Yet, RRI pedagogies such as inquiry based learning and argumentation are neither part of teacher training programmes nor frequently implemented in the classrooms – with an exception of inquiry based learning for age group 11-13. ***Specific guidelines on RRI teaching methodologies would particularly benefit the accomplishment of the aims of the project in the country***.

4.4.5. Context (informal settings, society) and RRI

In this section, we seek to gain an understanding on the degree to which there are connections between schools and informal setting with an aim to support RRI objectives, as well as on the degree on which the broader societal communities – in which students are active members- are aware of and support RRI initiatives. Information provided aims to facilitate dissemination work and the process of engaging informal educational providers in the project in the country.

Actors that promote RRI initiatives		Examples on how RRI initiatives are promoted
Associations and foundations	La Main à la pâte	• **Support and scaffolding of teachers** *EXAMPLE: La main à la pâte Fondation has developed a program of support for teacher through the involvement of scientists* • **Teacher training, seminar** • **Pilot activities** *EXAMPLE: Le Centre National des Arts et Métiers* (Nation center for Arts and Crafts) within the European project ENGINEER had proposed to limited number of school a • **Workshops and school visits to museum and science centres** • **Lobbying**
	Paris Montagne	
	Planète Science	
	Les Petits Débrouillards	
	Science Animation (Toulouse)	
	Les Atomes Crochus	
	Science Ouverte	
	Terre avenir	
	Association Science Technologie Société	
Science centre/museum	La Cité des sciences (Paris) Le Palais de la découverte (Paris) (Universcience)	
	AMCSTI (Association des musées et centres pour le développement de la culture scientifique, technique et industrielle) : National Association of museums and science centers	
	Museums d'Histoire Naturelle	
	Le Centre National des Arts et Métiers	
	La Casemate (Grenoble)	
	Cap sciences	
	Espace des sciences (Rennes)	
	Le Vaisseau (Strasbourg)	
	L'exploradôme	
	F93	

Actors that implement RRI initiatives	Implementation as part of …			
	…the national strategy	…school mission	…teaching strategy	Other (please explain)
Science centres and museum (ex: Nation center for Arts and Crafts, Universcience)	X		X	
Science national academies (The National Academy of	X		X	

chemistry)				
Regional house of science (see above)			X	
Key players association (ex: La main à la pâte)	X	X	X	

Connections between schools and informal education providers			
	Not Evident	***Evident but not prioritized***	***Evident and prioritized***

 **Primary schools**

 **General secondary schools**

 **Vocational Schools**

Students can participate in innovative educational projects in science based on partnerships with various informal education stakeholders from museums, cultural centres scientific to associations. Teacher training (both pre-service and in-service) is facilitated both by academics and stakeholder of informal education (popular education, cultural and artistic education, citizenship education, etc.)

4.4.6. Probable barriers and opportunities to the project

In the light of the curriculum analysis in France that was presented above, the following issues that emerge might have implications in various levels within the ENGAGE project:

Probable Barriers:

- For ***the age group 13-16***, the fact that recent changes in terms of RRI objectives have not yet reached classroom practice uncover ***a challenge and an opportunity for ENGAGE to have an actual impact in the country, by facilitating the transformation of policy envisions to classroom implementation.***

- A great variation in terms of prioritised curriculum objectives is evident at each grade in the country; it might be wise that ***the project resources localized for this country target specific student ages, rather than education levels*** (primary, secondary, higher) ***if best dissemination outcomes are to be achieved.***

- Similar to other countries involved in this study, content-base objectives are rather more prioritized in the country in comparison to objectives that are more RRI oriented. This may be ***a hindering factor in the process of engaging many sciences teachers in implementing the resources,*** especially those teaching age groups that are more close to final exams for entering higher education. ***The importance of addressing RRI aims in science teaching should be made explicit both during the workshops and the online courses.***

- The general picture of the science curriculum shows that ***content relating to RRI teaching is mainly not evident in the science curriculum.*** This might be a ***hindering factor for engaging big numbers*** of science teachers to implement ENGAGE RRI materials in the classrooms.

Probable Opportunities:

- ***In the process of localization and dissemination*** of the project's curriculum materials/recourses, the way science is taught in the country should be taken into consideration. For ***age group 11-12, resources dealing with multidisciplinary issues*** might be more relevant to the educational context; ***for age group 12-16 materials with content addressing a specific discipline*** should be preferred to resources in multidisciplinary format.

- ***Teachers involved in the courses of integrated science and technology education for age group 11-12*** and ***'exploration courses' for age groups 12-15 should be specifically targeted for being involved*** in the project, as many of the recourses being developed are highly relevant to the content of their teaching.

- Especially for ***age group 11-13 years old***, changes on policy envisions have been passed to the classroom level of actual implementation, providing ***a fruitful context for the accomplishment of the project goals in terms of prioritized objectives.***

- In terms of content, ***for age group 11-12***, ***resources relating to technology are more likely to be of implemented in the classrooms,*** than materials relating to technology, as the former are more evident in the curriculum and in formal assessment.

- ***For age group 13-15, resources relating to value are more likely to be implemented in the classrooms*** due to the fact that they such content is evident and/or prioritized in the curriculum of the country – yet the theme is not evident in formal assessment.

- There is ***a more fruitful educational context*** in the country for the aims of the ENGAGE project ***in terms actual implementation of inquiry based pedagogy in*** the classrooms ***for students ages 11-13*** than 13-16.

- RRI pedagogies such as inquiry based learning and argumentation are neither part of teacher training programmes nor frequently implemented in the classrooms – with an exception of inquiry based learning for age group 11-13. ***Specific guidelines on RRI teaching methodologies would particularly benefit the accomplishment of the aims of the project in the country***.

References

- **Policy :**
  - **The 25 Key Measures for school (Law 2013)**

http://cache.media.eduscol.education.fr/file/dossiers/77/1/25_key_measures_290771.pdf

- **Science and technology curriculum (only in French)**

Principle of free choice of pedagogy: Pursuant to Act No. 2005-380 of 23 April 2005 for guidance and curriculum for the future of the school, "the free choice of pedagogy of the teacher is exercised in accordance with curriculum and instructions of the National Education Minister and within the school or institution with the advice and under the supervision of members of inspection.
http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000259787&dateTexte=&categorieLien=id

Curriculums are therefore the only regulatory reference addressed to teachers.

- 11-14 years old
  http://www.education.gouv.fr/cid22120/mene0817023a.html

    - Physics and chemistry:
      http://www.education.gouv.fr/cid22120/mene0817023a.html
    - Biology and geology:
      http://cache.media.education.gouv.fr/file/special_6/52/7/Programme_physique-chimie_33527.pdf
    - Mathematics:
      http://cache.media.education.gouv.fr/file/special_6/52/5/Programme_math_33525.pdf
    - Technology:
      http://cache.media.education.gouv.fr/file/special_6/53/1/Programme_technologie_33531.pdf
- 15-16 years old
    - Physics and chemistry:
      http://cache.media.education.gouv.fr/file/special_4/72/9/physique_chimie_143729.pdf
    - Biology and geology:
      http://cache.media.education.gouv.fr/file/special_4/73/1/sciences_vie_Terre_143731.pdf
    - Mathematics:
      http://cache.media.education.gouv.fr/file/30/52/3/programme_mathematiques_seconde_65523.pdf
    - Exploration courses (Health and social issues
      http://cache.media.education.gouv.fr/file/special_4/73/9/sante_social_143739.pdf ; Biotechnology
      http://cache.media.education.gouv.fr/file/special_4/74/1/biotechnologies_143741.pdf)

- On ESPE (Higher Education School for teacher) – FRENCH ONLY:
  http://www.education.gouv.fr/cid72796/espe-les-ecoles-superieures-du-professorat-et-de-l-education.html
- On Sustainable development education – FRENCH ONLY:
  http://media.education.gouv.fr/file/2008/79/2/developpement_durable_S.V.T_et_synthese_24792.pdf
- On Houses of science – FRENCH ONLY : http://www.maisons-pour-la-science.org/

4.5. RRI Curriculum Analysis for the case of Romania

4.5.0. Background - Romania

Romania has a centralized educational system: there is a unique curriculum for each type of school and all the textbooks must be approved by a special organization of the Ministry of Education. There are 4 main types of schools: primary schools, upper primary schools (usually these two categories are organized together), secondary schools (these can be theoretical or vocational schools, but there are schools with both theoretical and vocational classes, the type of program being linked to the class, not to the school), apprentice schools. There is a final exam at the end of the secondary school, which is required for further studies (most of the universities use the results of this exam as admission criteria). In terms of science education, for students aged 10-11 it is mainly an interdisciplinary subject; for secondary school (age 11-14) is mainly disciplinary (biology, physics and chemistry), while for high school (age 15-16) is also disciplinary.

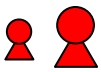
Probable implications to the project:

- The ***centralized educational system may not allow much autonomy for teachers to implement additional to textbooks materials in the classrooms***; in case of such a likelihood, this is an issue that should be taken into consideration in the preparation of the dissemination plan for the country especially in the ADOPT phase (WP4).

- The fact that science is taught mainly in a disciplinary manner should be taken into account ***in the process of localization and dissemination*** of the curriculum materials/recourses – in this case materials with content more relevant to each discipline should be preferred to resources in multidisciplinary format.

4.5.1. Recent curriculum changes in relation to RRI – Romania

The table below provides an indication on the degree to which aspects of RRI philosophy are (or are not) emerging in current or envisioned educational changes –-if evident - both in policy and in educational practice.

Changes relating to					
	…the envisioned curriculum				
	…the enacted curriculum				
	….teacher training				
		No change	***Not in line with RRI***	***Partly in line with RRI***	***In line with RRI***

 **Students 11-13 years old**

 **Students 13-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

There are no current changes in the country, in relation to the envisioned science curriculum, as expressed in policy making documents. The last reform was initiated in 2005, referring initially to primary education and being extended nowadays to secondary and high schools. The fact that curriculum reforms have gradually been introduced in the levels of educational systems is probably an explanation why changes in the enacted curriculum are currently taken place in the country. It should be noted that before 2005, the science curriculum was strictly content-based. In contrast, the new curriculum also contains some methodological suggestions and a brief description of competencies the students must posses. Current changes in the way science is taught in the classrooms are very likely to be in line with RRI philosophy, at least in terms of teaching methods. Indeed, interactive didactic strategies are being more frequently used (student-centred methods, group work, use of science in various contexts). However, in-service and pre-service teacher training is partly in line with RRI (mainly through the promotion of inquiry based learning), while both textbooks and examination criteria could be hardly considered as supporting teaching about RRI aspects.

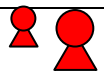
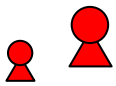
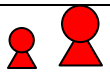
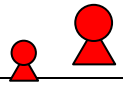
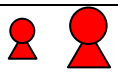
Probable implications to the project:

- Current changes in the country in terms of the enacted curriculum indicate that there is ***a rather fruitful context for the accomplishment of the ENGAGE aims, in terms of the implemented pedagogies***.

- The fact that the textbooks could be hardly considered as supporting about RRI aspects is ***an opportunity for the project to promote resources*** that are more relevant both to the envisioned curriculum and to practitioners; teaching needs.

4. 5.2. Curriculum objectives and expected outcomes in relation to RRI – Romania

The table below illustrates the prioritized objectives in the curriculum and in the formal assessment in the country.

Objectives and outcomes prioritized	***Acquisition of scientific knowledge***	*Policy documents*			
		Formal assessment			
	Development of scientific skills	*Policy documents*			
		Formal assessment			
	Acquisition of Values	*Policy documents*			
		Formal assessment			
			Not a priority	***Medium Priority***	***High Priority***

 **Students 11-13 years old**

 **Students 13-16 years old**

As reported by the Romanian partners, the prioritized objectives in the envisioned curriculum are partly in line with RRI philosophy both for students age 11-13 and 13-16: indeed of high priority in policy documents are learning objectives relating to the acquisition of scientific knowledge, and of medium priority objectives relating to the development of scientific skills and the acquisition of values. This is also the picture as far as the expected learning outcomes that are assessed in the countries' formal assessment. Similar to other countries it seems the content-based objectives remain the main focus of the science curriculum, while the development of skills and the consideration of values in science are considered as secondary aims.

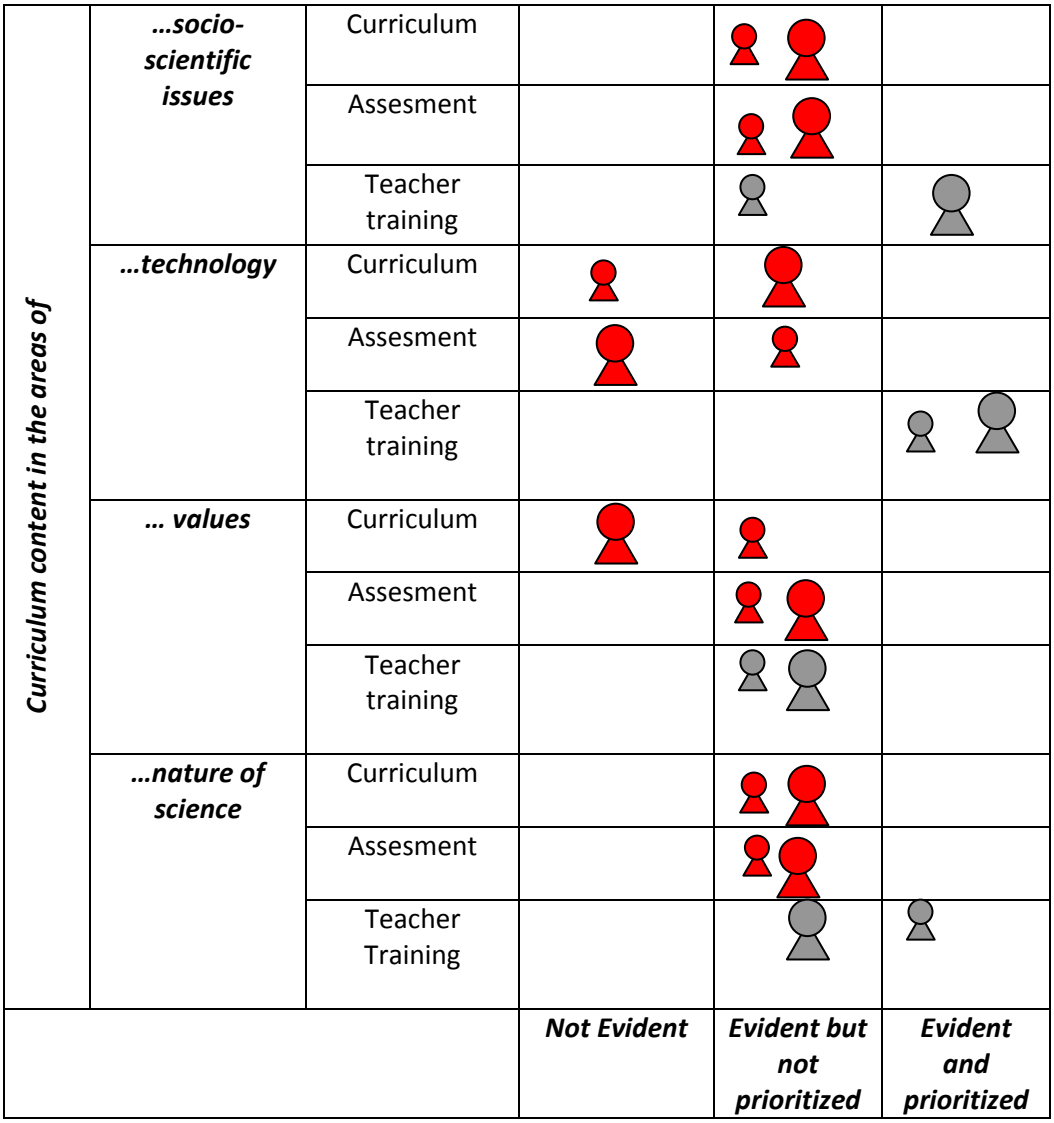
Probable implications to the project:

- The fact that content-base objectives are rather more prioritized in the country in comparison to objectives that are more RRI oriented may be ***a hindering factor in***

the process of engaging many sciences teachers in implementing the resources, especially those teaching age groups that are more close to final exams for entering higher education. ***The importance of addressing RRI aims in science teaching should be made explicit both during the workshops and the online courses.***

4. **5.3. Curriculum Content and RRI (socio-scientific issues, technology, values, nature of science) – Romania**

This section aims to provide an understanding on whether or not (and up to what degree) themes relating to socio-scientific issues, technology, values, nature of science are evident and prioritized in the curriculum of the country.



Students 11-12 years old

Students 13-16 years old

Pre-service teachers

In-Service teachers

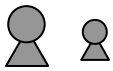
As shown in the table, most of the thematic areas of the RRI curriculum may be evident but not prioritized in the envisioned curriculum and the assessment for both age groups. In addition, themes that are not evident at the curriculum or the assessment are: for age group 11-12 technology; for age group 13-16 technology and values, so there seems to be low likelihood that resources in this thematic will engage a large number of teachers in the country. It should be noted, though, that as far as teacher training is concerned the areas of technology and values are evident and prioritized, therefore recourses on the thematic may attract teachers that would like to implement extra-curricular activities.

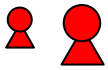
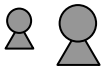
Probable implications to the project:

- In terms of content, ***for age group 11-12***, ***resources relating to socio-scientific issues, values and nature of science are more likely to be of implemented in the classrooms,*** than materials relating to technology.
- ***For age group 13-16, resources relating to values are less likely to be implemented in the classrooms*** due to the fact that they are not part of the curriculum in the country.

4. 5. 4. Pedagogical processes and RRI – Romania

One aspect of the curriculum has to do with the pedagogical processes that are proposed in the curriculum and that are actually implemented in the classrooms. The tables below show whether or not pedagogical strategies such as IBL and argumentation (that relate to RRI objectives) are evident and prioritized in the country.

Inquiry-Based Learning	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

Argumentation	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

 **Students 11-13 years old**

 **Students 13-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

As reported by the Romanian partners, both inquiry-based leaning methodology and argumentation are parts of the teacher training programs – in-service and pre-service. The

familiarization of teachers with pedagogies that come to support RRI objectives constitutes an opportunity for the project to achieve its aims and contribute to the wide-spread implementation of RRI thematic. It should be noted though that despite recent trends, inquiry based learning is still not frequently implemented in the classrooms, mainly due to time constrains.

Probable implications to the project:

- There is ***a fruitful educational context*** in the country for the aims of the ENGAGE project ***in terms of familiarization of teachers with RRI pedagogies***.
- ***Time constrains*** have been reported as the reason for not frequent implementation of inquiry based learning in the classrooms; this ***should be taken into account for the development of guidelines for using the resources in the classroom*** - maybe the principle "less is more" would benefit the development of the resources, in terms of the number of issues that students are supposed to be engaged in, during one teaching period.

4. 5.5. Context (informal settings, society) and RRI - Romania

In this section, we seek to gain an understanding on the degree to which there are connections between schools and informal setting with an aim to support RRI objectives, as well as on the degree on which the broader societal communities – in which students are active members- are aware of and support RRI initiatives. Information provided aims to facilitate dissemination work and the process of engaging informal educational providers in the project in the country.

Actors that promote RRI initiatives	Examples on how RRI initiatives are promoted
Formal and informal educator providers	In the frame of CPD training programmes, there are workshops that include or promote RRI.
Museums	By their own training programmes dedicated to general public.

Actors that implement RRI initiatives	Implementation as part of …			
	…the national strategy	…school mission	…teaching strategy	Other (please explain)
Formal and informal educator providers			In the frame of CPD training programmes, there are workshops that include or promote RRI.	
Museums			In the frame of CPD training programmes, there are workshops that include or promote RRI.	

Main Actors: Valahia University; Dambovita County School Inspectorate; National Complex Museum “Curtea Domneasca” Targoviste, Prahova Natural Science Museum

Connections between schools and informal education providers			
	Not Evident	***Evident but not prioritized***	***Evident and prioritized***

 **Primary schools**

 **General secondary schools**

 **Vocational Schools**

4. 5.6. Probable barriers and opportunities to the project

From the curriculum analysis in Romania that was presented above, the following issues emerges that might have implications for various levels within the ENGAGE project:

Probable Barriers:

- One issue that might be a barrier is the degree of the ***autonomy that teachers have*** to implement additional to textbooks materials in the classrooms due to the highly centralized educational system.
- Another probable barrier is the fact that content-base objectives are rather more prioritized in the country in comparison to objectives that are more RRI oriented. This may be a ***hindering factor in the process of engaging many sciences teachers in implementing the resources***.
- Time constrains have been reported as the reason for not frequent implementation of inquiry based learning in the classrooms; ***this should be taken into account for the development of guidelines*** for using the resources in the classroom.

Probable Opportunities:

- ***Resources with content more relevant to each discipline*** rather than resources addressing multidisciplinary issues might be more appropriate in this country due to the way science is taught (mainly disciplinary).
- There is a ***rather fruitful context for the accomplishment of the ENGAGE aims, in terms of the implemented pedagogies*** and in terms of familiarization of teachers with RRI pedagogies.
- The fact that the textbooks could be hardly considered as supporting about RRI aspects is ***an opportunity for the project to promote resources*** that are more relevant both to the envisioned curriculum and to practitioners; teaching needs.
- ***In terms of content***, for ***age group 11-12***, resources relating ***to socio-scientific issues, values and nature of science*** are more likely to be of implemented in the classrooms, than materials relating to technology. For ***age group 13-16***, resources relating to ***socio-scientific issues, technology and nature of science*** are more likely to be implemented in the classrooms.

References

*** “Educaţie şi cercetare pentru societatea cunoaşterii” retrieved at: http://www.presidency.ro/static/ordine/Educatie_si_Cercetare_pentru_Societatea_Cunoasterii.pdf
*** “Programul de guvernare 2013 – 2016. Sectiunea: Educatie.”, Guvernul Romaniei

4. 6. RRI Curriculum Analysis for the case of Israel

4. 6.0. Background – Israel

The educational system of Israel consists of three tiers: primary education (grades 1-6, approx. ages 6–12), middle school (grades 7-9, approx. ages 12–15) and high school (grades 10-12, approx. ages 15–18). Compulsory education takes place from kindergarten through to 12th grade. In terms of how science is taught at different age levels, for upper elementary level (age 11-12) and for middle school (age 13-15) science is mainly interdisciplinary, while for high school (age 15-16) is mainly disciplinary (i.e. biology, chemistry, physics). More modern approach such as biotechnology, environmental sciences and even pre-medicine programmes are offered to a minority of students.

Probable implications to the project:

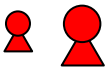
- ***In the process of localization and dissemination*** of the project's curriculum materials/recourses, the way science is taught in the country should be taken into consideration. For ***age group 11-15, resources dealing with multidisciplinary issues*** might be more relevant to the educational context; ***for age group 15-16 materials with content addressing a specific discipline*** should be preferred to resources in multidisciplinary format.

- ***Middle-school science teachers are the dominant target population***, given that the multidisciplinary framework is most suitable for involvement in ENGAGE.

- *Regarding the High-School level:* ***Teachers involved in science-for all, biotechnology, environmental sciences and even pre-medicine programmes should be specifically targeted for being involved*** in the ADOPT phase of the ENGAGE and continue to the ADAPT and TRANSFORM phases, as many of the recourses being developed are highly relevant to the content of their teaching.

4. 6.1. Recent curriculum changes in relation to RRI- Israel

The table below provides an indication on the degree to which aspects of RRI philosophy are (or are not) emerging in current or envisioned educational changes –-where evident - both in policy and in educational practice.

Changes relating to					
	…the envisioned curriculum				
	…the enacted curriculum				
	….teacher training				
		No change	***Not in line with RRI***	***Partly in line with RRI***	***In line with RRI***

 **Students 11-13 years old**

 **Students 13-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

As evident in the table, almost no changes have been reported by the partners of Israel, both in relation to the envisioned curriculum and enacted curriculum for 11-13 years old, and as far as pre-service teacher training and in-service professional development are concerned. In contrast, for students' age group 13-14 years old, recent policy documents imply a turn to RRI objectives, mainly by encouraging science teachers to introduce and implement value oriented and moral issues to their teaching. However, there are no elaborative documents with recommendations on how teachers could best address such an objective. In addition, it should be noted that the turn to more RRI objectives as evident in policy documents for 13-16 years old students have not yet been transformed from policy envisions to actual educational practice, given that no changes have been reported for this age group in terms of how science is currently implemented in the classrooms.

Probable implications to the project:

- ***Science teachers for age group 13-16 should be particularly targeted for participating in the face-to-face workshops and in the online courses in the country***, given that for this age group recent curriculum changes in the envisioned curriculum advocate a turn towards RRI teaching - mainly in terms of addressing value oriented and moral issues.

- The project should ***take advantage the lack of specific recommendations from policy on how teachers should best implement value oriented and moral issues to their teaching***: in the processes of disseminating the projects' outputs and of engaging teachers in the ENGAGE RRI community, the project should build on the

absence of elaborating RRI policy documents in the country, by ***making explicit how our project fills this gap*** – for example by the provision of ready to use materials in the ADOPT phase, provision of specific guidelines on how to use the materials, familiarization with teaching strategies that are more likely to lead to the accomplishment of RRI objectives.

- The fact that recent changes in terms of RRI objectives have not yet reached classroom practice uncover ***a challenge and an opportunity for ENGAGE to have an actual impact in the country, by facilitating the transformation of policy envisions to classroom implementation***.

4. 6.2. Curriculum objectives and expected outcomes in relation to RRI- Israel

The table below illustrates the prioritized objectives that are evident in the curriculum and in the formal assessment in the country.

Objectives and outcomes prioritized					
	Acquisition of scientific knowledge	*Policy documents*			
		Formal assessment			
	Development of scientific skills	*Policy documents*			
		Formal assessment			
	Acquisition of Values	*Policy documents*			
		Formal assessment			
			Not a priority	***Medium Priority***	***High Priority***

Students 11-13 years old **Students 13-14 years old** **Students 14-16 years old**

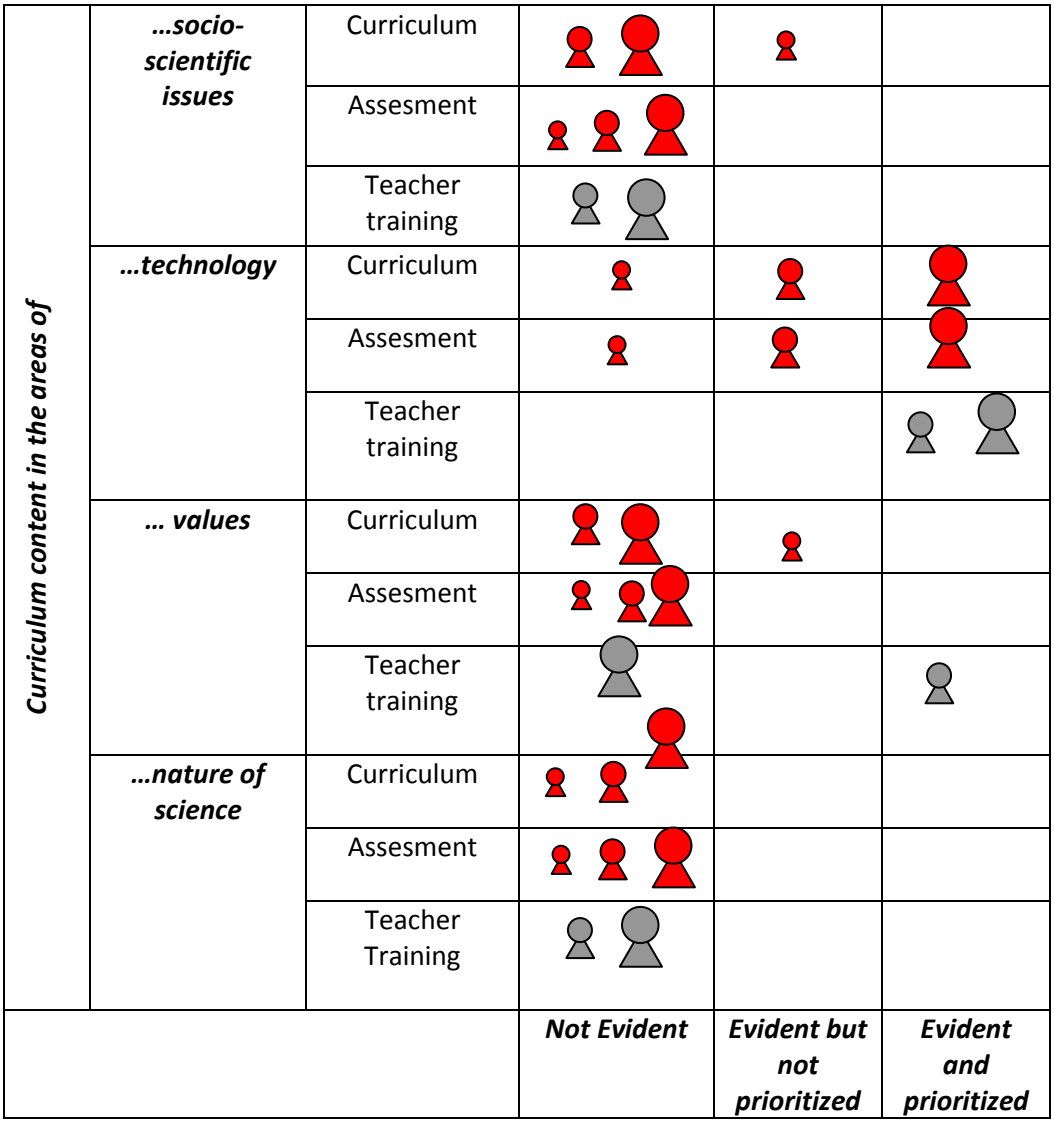
As reported by the Israeli partners, the prioritized objectives in the envisioned curriculum are partly in line with RRI philosophy for students age 11-13, while they seem to be not in line with RRI for ages 13-16. In specific, as illustrated in the table above, for all age groups objectives relating to the acquisition of scientific knowledge seem to be of high priority in science teaching for all age groups. This is also the case as far as the expected learning outcomes that are assessed in the countries' formal assessment. In addition, learning objectives that are of high priority are the development of scientific skills for 14-16 years old, while the acquisition of values is prioritized for the youngest age group (11-13 years old).

Probable implications to the project:

- ***In terms of prioritized objectives*** in the current science curriculum and assessment, ***the age group 11-14 years old seem to provide a more fruitful context in the country*** for achieving the project's goals than age group 14-16.

4. **6.3. Curriculum Content and RRI (socio-scientific issues, technology, values, nature of science) – Israel**

This section aims to provide an understanding on whether or not (and up to what degree) themes relating to socio-scientific issues, technology, values, nature of science are evident and prioritized in the curriculum of the country.



Students 11-12 years old **Students 12-14 years old** **Students 14-16 years old**

Pre-service teachers **In-Service teachers**

As evident in the table, most of the thematic areas of the RRI curriculum are not evident in the envisioned curriculum and the assessment for all age groups. In specific, content that is highly evident and prioritized is technology for age groups 12-14 and 14-16, while content relating to values for ages 11-12. The nature of science does not seem to be a part of the countries curriculum in terms of content for all age groups. It should be noted, though, that as far as teacher training is concerned the areas of technology and values are evident and prioritized, therefore recourses on the thematic may attract teachers that would like to implement extra-curricular activities.

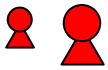
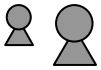
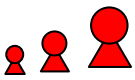
Probable implications to the project:

- In terms of content, ***for age group 11-12***, ***resources relating to socio-scientific issues and technology are more likely to be of implemented in the classrooms,*** than materials relating to technology, as the former are more evident in the curriculum.
- ***For age group 12-16, resources relating to technology are more likely to be implemented in the classrooms*** due to the fact that they such content is evident and/or prioritized in the curriculum of the country.

4. 6. 4. Pedagogical processes and RRI – Israel

One aspect of the curriculum has to do with the pedagogical processes that are proposed in the curriculum and that are actually implemented in the classrooms. The tables below show whether or not pedagogical strategies such as IBL and argumentation (that relate to RRI objectives) are evident and prioritized in the country.

Inquiry-Based Learning	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

Argumentation	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

 **Students 11-12 years old**

 **Students 12-14 years old**

 **Students 14-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

As reported by the Israeli partners, inquiry-based leaning is evident in the curriculum and frequently implemented in the classrooms for age group 12-16. In addition, it is a part of teacher training programs both in-service and pre-service. In contrast argumentation is neither evident in teacher training, nor frequently implemented in the classrooms for all age groups. Specific guidelines on how teachers could deal with RRI themes in the classroom engaging students in argumentative discourse would particularly benefit the accomplishment of the aims of the project in the country.

Probable implications to the project:

- There is ***a fruitful educational context*** in the country for the aims of the ENGAGE project ***in terms of familiarization of teachers with inquiry based learning and actual implementation of the pedagogy in*** the classrooms.
- In contrast***, argumentation*** is neither evident in teacher training, nor frequently implemented in the classrooms for all age groups. ***Specific guidelines on how teachers could deal with RRI themes in the classroom engaging students in argumentative discourse*** would particularly benefit the accomplishment of the aims of the project in the country.

4. 6.5. Context (informal settings, society) and RRI – Israel

In this section, we seek to gain an understanding on the degree to which there are connections between schools and informal setting with an aim to support RRI objectives, as well as on the degree on which the broader societal communities – in which students are active members- are aware of and support RRI initiatives. Information provided aims to facilitate dissemination work and the process of engaging informal educational providers in the project in the country

Actors that promote RRI initiatives	Examples on how RRI initiatives are promoted
National Science teachers centres in the areas of: physics, chemistry, biology, science for all and environmental studies	Promoting teachers professional development programs and frameworks Publish teachers professional
The super-intendants of all taught scientific subjects	recommend the ministry of education
Science centres such as Davidson centre	Design and Invite students to activities which includes research
The science education academic community (researchers)	Discuss and disseminate RRI ideas in publications, seminars, lectures

Connections between schools and informal education providers			
	Not Evident	***Evident but not prioritized***	***Evident and prioritized***

 **Primary schools**

 **General secondary schools**

 **Vocational Schools**

4. 6.6. Probable barriers and opportunities to the project- Israel

From the curriculum analysis in Israel that was presented above, the following issues that emerge might have implications in various levels within the ENGAGE project:

Probable Barriers:

- Recent curriculum changes may indicate a turn towards RRI teaching objectives but they have not yet reached classroom practice. It is ***a challenge for ENGAGE to have an actual impact in the country, by facilitating the transformation of policy envisions to classroom implementation***.

- Despite the fact that RRI objectives are evident in the country according to recent curriculum changes for ages 14-16, there is a lack ***of specific recommendations from policy on how teachers should best implement value oriented and moral issues to their teaching***. The project should build on the absence of elaborating RRI policy documents in the country, by ***making explicit how our project fills this gap*** – for example by the provision of ready to use materials in the ADOPT phase, provision of specific guidelines on how to use the materials, familiarization with teaching strategies that are more likely to lead to the accomplishment of RRI objectives.

- ***Argumentation*** is neither evident in teacher training, nor frequently implemented in the classrooms for all age groups. ***Specific guidelines on how teachers could deal with RRI themes in the classroom engaging students in argumentative discourse*** would particularly benefit the accomplishment of the aims of the project in the country.

Probable Opportunities:

- Given the way science is taught in the country, for ***age group 11-15, resources dealing with multidisciplinary issues*** might be more relevant to the educational context; ***for age group 15-16 materials with content addressing a specific discipline*** should be preferred to resources in multidisciplinary format.

- ***Teachers involved in biotechnology, environmental sciences and even pre-medicine programmes should be specifically targeted for being involved*** in the ADOPT phase of the ENGAGE and continue to the ADAPT and TRANSFORM phases, as many of the recourses being developed are highly relevant to the content of their teaching.

- ***Science teachers for age group 13-16 should be particularly targeted for participating in the face-to-face workshops and in the online courses in the country***, given that for this age group recent curriculum changes in the envisioned curriculum advocate a turn towards RRI teaching - mainly in terms of addressing value oriented and moral issues.

4. 7. RRI Curriculum Analysis for the case of Spain

4. 6.0. Background - Spain

Spain is currently starting a new Educational Law named "Organic Law for the Improvement of the Quality of Education». It is going to be partially deployed in the next academic year (2014-15), so there are a lot of uncertainties in respect to the contents, methodologies, etc. No new textbooks have been published to this date. Because of that, there is certain speculation in the content of this report.

At age 10–12 years children follow the third cycle of primary education. Until now and during the current academic year (2014) science is studied in an interdisciplinary subject "Natural, Social and Cultural environment" ("Medio Natural, Social y Cultural"). Starting from the academic year 2014-2015 (according to the new LOMCE proposal [References 1, 2, 3]) sciences will be studied within a separate specific subject called "Natural sciences" and divided from the "Social sciences".

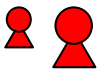
At age 12-14 years children follow the first cycle of compulsory secondary education (ESO). Sciences will be studied (according to the new LOMCE proposal, starting from academic year 2015-2016) within the following subjects "Geography and history", "Biology and geology", and "Physics and chemistry".

Probable implications to the project:

- Due to an educational reform that is planned to be implemented in the following academic year – with many of its aspects needing more elaboration by policy makers – ***the broader educational scenery in the country is unclear***.
- Educational reform in the country could be seen not only as a challenge but also as an ***opportunity*** for the project, given that curriculum change always ***provides the potential to 'sell' professional development as providing appropriate up-skilling towards implementation.***

4. 7.1. Recent curriculum changes in relation to RRI – Spain

The table below provides an indication on the degree to which aspects of RRI philosophy are (or are not) emerging in current or envisioned educational changes –-where evident - both in policy and in educational practice.

Changes relating to		*No change*	*Not in line with RRI*	*Partly in line with RRI*	*In line with RRI*
	…the envisioned curriculum				
	…the enacted curriculum				
	….teacher training				

 **Students 11-12 years old**

 **Students 12-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

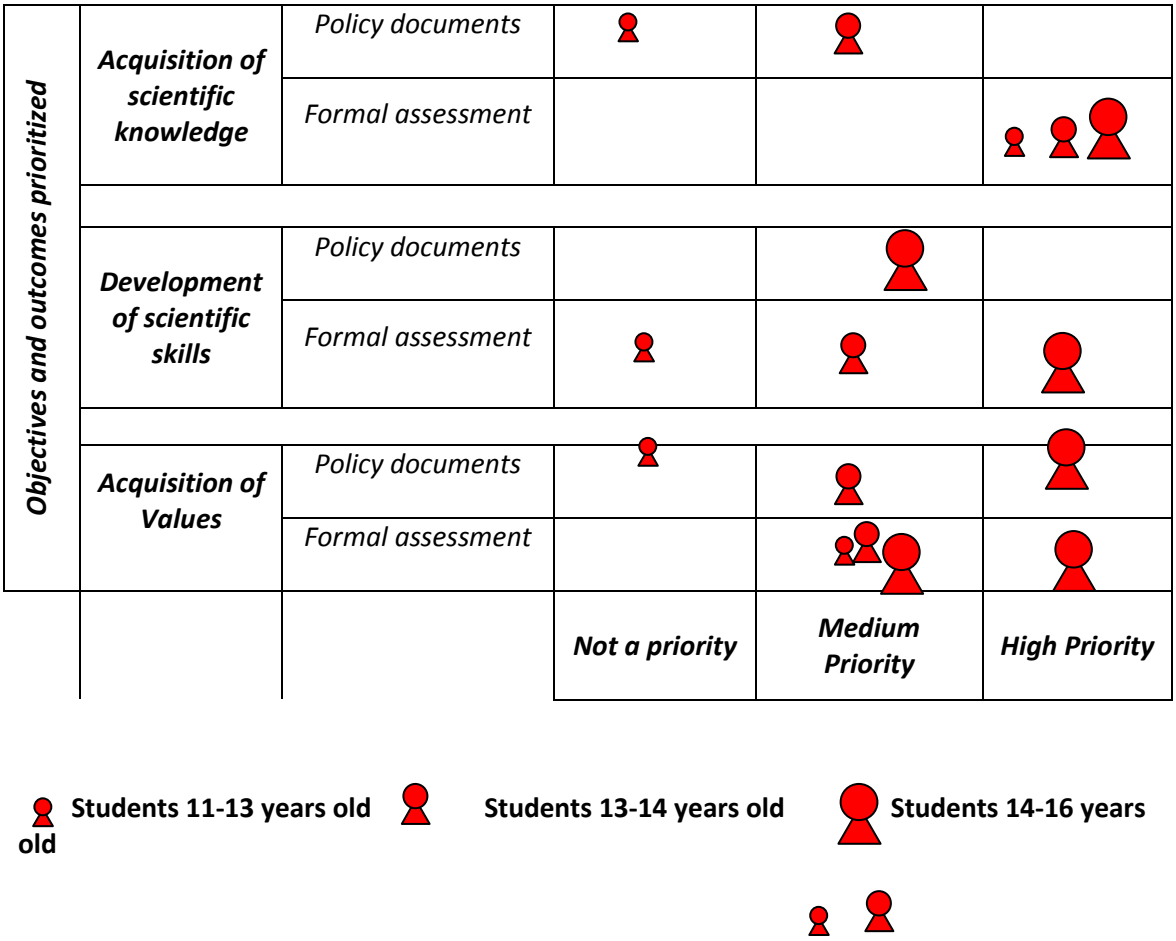
As reported by the Spanish partners, the current Spanish National Curriculum for ages 11-5 (LOE from 2006) partially encourages inquiry and certain RRI topics, such as reflections on the influence of human activities on the environment, the responsible use of natural resources, interpretation of scientific information [Reference 4, see "competence in the understanding and interaction with the physical world"]. It is expected that the encouragement of IBSE will be also supported by the new LOMCE curriculum for secondary education. For students age 15-16, one of the objectives is that the upper secondary education should help develop in the students the capabilities "to understand the basic elements and procedures of the research and scientific methods." Current changes in the enacted curriculum are partly in line with RRI objectives, with further changes being expected in 2015-16, following policy recommendations. As for teacher training, pre-service teachers are not in line with RRI objectives, in contrast to in-service teachers, which sometimes focus on inquiry-based methodologies and how scientific knowledge is constructed. The LOMCE proposal stimulates the use of technologies. It also opens the opportunity for continuous teacher training for scientific knowledge and suggests specific CPD training would be offered. The offer is expected during the next academic year.

Probable implications to the project:

- There is much policy change in the country. Although many of its aspects are still unclear, there is evidence that curriculum is partly in line with RRI objectives. ***It is an opportunity for ENGAGE to have an actual impact in the country, by facilitating the transformation of policy envisions to classroom implementation***.

4. 7.2. Curriculum objectives and expected outcomes in relation to RRI- Spain

The table below illustrates the prioritized objectives that are evident in the curriculum and in the formal assessment in the country.



Students 11-13 years old **Students 13-14 years old** **Students 14-16 years old**

As evident in the table above, for student age group 11-13 years old the main objective of the science curriculum is the acquisition of values, while the acquisition of scientific knowledge is less emphasized in the curriculum documents. For students age 13-16 all the above mentioned objectives seems to be equally of medium priority. Despite policy visions, though, in terms of assessment, the acquisition of scientific knowledge seems to be highly prioritized for all age groups. Especially for age group 14-16, equally prioritized are objectives relating to scientific skills and values. In total, according to the Spanish partners, the science curriculum of the country seems to be not in line will RRI objectives for 11-13 years old and partly in line for 13-16 years old; aspects of RRI that are evident *for age groups 12-13 are Sustainability, environmental impact of the human activities* and for age group 15-16 phase of research how science works, designing experiments.

Probable implications to the project:

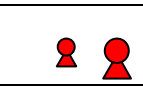
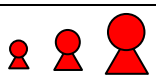
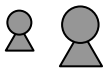
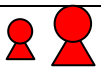
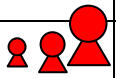
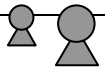
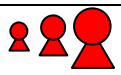
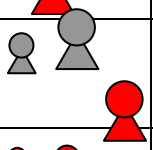
- With the assumption that objectives evident in assessment receive more attention than policy declarations in the envisioned curriculum by teachers it seems that in

Spain ***content-base objectives are rather more prioritized*** in the country in comparison to objectives that are more RRI oriented; this might be ***a hindering factor need to be taken into consideration in the process of engaging sciences teachers in implementing in the classrooms resources that relate to RRI objectives.***

- ***In terms of curriculum objectives and expected outcomes, the age group 14-16 years old seems to be a more fruitful context*** for the accomplishment of projects' objectives than age group 11-14 years old.

4. **7.3. Curriculum Content and RRI (socio-scientific issues, technology, values, nature of science) – Spain**

This section aims to provide an understanding on whether or not (and up to what degree) themes relating to socio-scientific issues, technology, values, nature of science are evident and prioritized in the curriculum of the country.

Curriculum content in the areas of	***…socio-scientific issues***	Curriculum			
		Assesment			
		Teacher training			
	…technology	Curriculum			
		Assesment			
		Teacher training			
	… values	Curriculum			
		Assesment			
		Teacher training			
	…nature of science	Curriculum			
		Assesment			
		Teacher Training			
			Not Evident	***Evident but not prioritized***	***Evident and prioritized***

 Students 11-12 years old  **Students 12-14 years old**  **Students 14-16 years old**

Pre-service teachers **In-Service teachers**

As evident in the table above, most of the thematic areas of the RRI curriculum may be evident but not prioritized in the envisioned curriculum and the assessment for all age groups. In specific, socio-scientific issues for age group 11-12 are only evident in an elective subject ("Ethical values"), while for age groups 12-16, relating topics are: sustainable development, scientific knowledge, and ecosystems. In terms of technology, for age groups 11-14, it is expected to be covered more within the LOMCE, while for age group 14-16 in the subject technology and in experimental sciences. Values might be evident in the subject "Ethical Values", but it is not clear given the curriculum reforms. For students 11-12 years old, in Natural Sciences, a thematic area named "Initiation to the Scientific Activity" [5] might be relevant to the thematic of nature of science. Finally for 12-16 years old, with the new law there is no information yet, but presumably the nature of science might be present in Natural Sciences, Physics, Technology, and Maths. Similarly, content relating to RRI thematic is either evident but not prioritized or not evident at all (for example socio-scientific issues), as far as teacher training is concerned. In terms of technology, issues the impact and use of ICT in education and society are evident while content relating to values is rarely related to experimental sciences. In terms of the nature of science some in-service courses partially include issues of this type, especially when dealing with inquiry-based science methodologies.

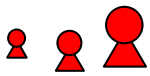
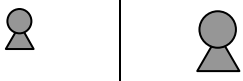
Probable implications to the project:

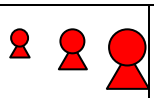
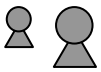
- In terms of content, for ***age group 14-16***, ***resources relating to values and nature of science are more likely to be of implemented in the classrooms,*** as these areas are evident (even if not prioritized) both in the science curriculum and the formal assessment in the country.

- Themes relating to RRI are either evident but not prioritized (for example technology, teacher training) or nor evident at all (for example values), both in in-service and pre-service teacher training, indicating ***that teachers' content background on the area might be limited.*** ENGAGE workshops and online courses on teacher training of RRI materials may prove particularly helpful in this regard.

4. 7. 4. Pedagogical processes and RRI – Spain

One aspect of the curriculum has to do with the pedagogical processes that are proposed in the curriculum and that are actually implemented in the classrooms. The tables below show whether or not pedagogical strategies such as IBL and argumentation (that relate to RRI objectives) are evident and prioritized in the country.

Inquiry-Based Learning	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

Argumentation	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

 **Students 11-12 years old**

 **Students 12-14 years old**

 **Students 14-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

As reported by the Spanish partners, inquiry based methodology is mentioned in the new educational law; however it seems to be more a policy intension and is not frequently been implemented in the classrooms. One reason for this is that there are not yet appropriate textbooks and specific guidelines to the teachers. As for in-service Continuous Professional Development (CPD), there are programmes that offer inquiry oriented courses, but they are not compulsory and there are no structured CPD plans or paths defined, i.e. choices depend on the teacher interest. In short, inquiry base methods are implemented in the classrooms partially and in isolated cases, mainly by innovative and highly motivated teachers. In relation to argumentation, it is not evident either in the envisioned curriculum for all age groups or in teachers training programmes. Yet it is frequently implemented for the age group 15-16 years old, mainly in the subject "Project work", which is offered by the schools on some regions, such as Catalonia. For students 11-15 years old some aspects of argumentation are evident in the classroom (for example in implementation of problem solving methodologies) but it is not frequently implemented in the classrooms.

Probable implications to the project:

- Teachers do not seem to be familiar with RRI teaching methodologies such as inquiry based learning or argumentation. ***Specific guidelines on implementing argumentation would particularly benefit the accomplishment of the aims of the project in the country***.

- Both ***inquiry based learning*** and ***argumentation are*** not frequently implemented in the classrooms. Further elaboration is needed ***on the reasons for not frequent implementation of such methodologies in the country, in order teachers are to be facilitated in practice in implementing ENGAGE RRI resources.***

4. 7.5. Context (informal settings, society) and RRI – Spain

In this section, we seek to gain an understanding on the degree to which there are connections between schools and informal setting with an aim to support RRI objectives, as well as on the degree on which the broader societal communities – in which students are active members- are aware of and support RRI initiatives. Information provided aims to facilitate dissemination work and the process of engaging informal educational providers in the project in the country

Actors that promote RRI initiatives	Examples on how RRI initiatives are promoted
Museums	*Some science museums provide talks RRI oriented:* - *CosmoCaixa – organises topical conferences and temporary expositions (e.g. In 2013 CERN, ecotendencias talks about global warming)*
Innovation projects	*Some European, national and regional projects are introducing RRI initiatives, but very limited in terms of impact up to now* - *Fundació LaCaixa, project RRI tools started in 2014* - *Fisica/Quimica/Bioligia en context per al Batxillerat – a Project for pedagogical innovation of science, base don IBSE, promoting the contextualization of science learning and linking the topics to real life issues. Supported by the regional government (CESIRE-CDEC, Generalitat de Catalunya)*
Press	- *Journalists specialised in science news in all large journals and newspapers* - *ENCIENDE- a portal supported by the ministry of education, serves for dissemination to teachers of projects, courses, materials. This includes also IBSE and RRI ones.*
Others	- *ACCC: Associació Catalana de Comunicació Científica and many other organisations that focus on scientific dissemination* - *Most research institutions that deal with issues that provoke controversies, such as nanotechnology, cancer or genetics research, etc., dedicate efforts (e.g. seminars and dissemination) to RRI aiming at the general public and sometimes to schools*

Actors that implement RRI initiatives	Implementation as part of …			
	…the national strategy	…school mission	…teaching strategy	Other (please explain)
Science				*Many research institution, as part of*

centres				*their visibility policy organise open days for general public and schools, cycles of dissemination conferences with researchers for the general public, visits to the science centers, materials. Examples* - *Parc Cientific de Barcelona (PCB), projects like ExploraHealth* - *PRBB - Parc de Recerca Biomèdica de Barcelona.* - *Institut de Biologia Evolutiva, initiative http://www.lacienciaalteumon.cat/* - *Fundaciorecerca*
Press				*News about scientific discoveries, controversies, etc. All newsletters in science and/or society sections.*
Science museums				*Cycles of Conferences with experts, visits, temporary expositions on technology : CosmoCaixa*
Others				*Organisations dedicated to scientific dissemination and links with society. E.g. BioComuniCA'T-organises science cafes that often treat controversial issues*

Connections between schools and informal education providers			
	Not Evident	***Evident but not prioritized***	***Evident and prioritized***

 **Primary schools**

 **General secondary schools**

 **Vocational Schools**

4. 7.6. Probable barriers and opportunities to the project- Spain

From the curriculum analysis in Spain that was presented above, the following issues that emerge might have implications for various levels within the ENGAGE project:

Probable Barriers:

- Due to an educational reform that is planned to be implemented in the following academic year – with many of its aspects needing more elaboration by policy makers – ***the broader educational scenery in the country is unclear.***

- With the assumption that objectives evident in assessment receive more attention than policy declarations in the envisioned curriculum by teachers it seems that in Spain ***content-base objectives are rather more prioritized*** in the country in comparison to objectives that are more RRI oriented; this might be ***a hindering factor need to be taken into consideration in the process of engaging sciences teachers in implementing in the classrooms resources that relate to RRI objectives.***

- Themes relating to RRI are either evident but not prioritized (for example technology, teacher training) or nor evident at all (for example values), both in in-service and pre-service teacher training, indicating ***that teachers' content background on the area might be limited.*** ENGAGE workshops and online courses on teacher training of RRI materials may prove particularly helpful in this regard.

- Teachers do not seem to be familiar with RRI teaching methodologies such as inquiry based learning or argumentation. ***Specific guidelines on implementing argumentation would particularly benefit the accomplishment of the aims of the project in the country***.

Probable Opportunities:

- Educational reform in the country could be seen not only as a challenge but also as an ***opportunity*** for the project, given that curriculum change always ***provides the potential to 'sell' professional development as providing appropriate up-skilling towards implementation.***

- ***In terms of curriculum objectives and expected outcomes, the age group 14-16 years old seems to be a more fruitful context*** for the accomplishment of projects' objectives than age group 11-14 years old.

- In terms of content, for ***age group 14-16***, ***resources relating to values and nature of science are more likely to be of implemented in the classrooms,*** as these areas are evident (even if not prioritized) both in the science curriculum and the formal assessment in the country.

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4. 8. RRI Curriculum Analysis for the case of Norway

4. 8.0. Background - Norway

To provide a general picture of the Norwegian educational system, the organization of education in the country is as follows: Primary school (students age 6-12years old); Lower secondary school (students age 13-15 years old); Upper secondary school (students 16-18 years old).

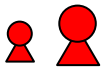
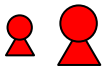
In terms of how science is taught at the different levels, it is mainly multidisciplinary for the project target group 11- 16 years old. The curriculum also includes topics that are interdisciplinary (such as science in society).

Probable implications to the project:

- The way science is taught in the country should be taken into consideration ***In the process of localization and dissemination*** of the project's curriculum materials/recourses. For the Norwegian educational context and for age groups 11-16, ***resources dealing with multidisciplinary issues*** should be preferred to resources relating to particular disciplines (physics, biology, chemistry).

4. 8.1. Recent curriculum changes in relation to RRI – Norway

The table below provides an indication on the degree to which aspects of RRI philosophy are (or are not) emerging in current or envisioned educational changes –-where evident - both in policy and in educational practice.

Changes relating to					
	…the envisioned curriculum				
	…the enacted curriculum				
	….teacher training				
		No change	***Not in line with RRI***	***Partly in line with RRI***	***In line with RRI***

 **Students 11-12 years old**

 **Students 12-16 years old**

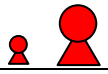
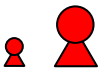
 **Pre-service teachers**

 **In-Service teachers**

No recent changes have been reported by the Norwegian partners in the science curriculum in the country that might have an implication to the project.

4. 8.2. Curriculum objectives and expected outcomes in relation to RRI – Norway

The table below illustrates the prioritized objectives that are evident in the curriculum and in the formal assessment in the country.

Objectives and outcomes prioritized	***Acquisition of scientific knowledge***	*Policy documents*			
		Formal assessment			
	Development of scientific skills	*Policy documents*			
		Formal assessment			
	Acquisition of Values	*Policy documents*			
		Formal assessment			
			Not a priority	***Medium Priority***	***High Priority***

 **Students 11-12 years old**  **Students 13-16 years old**

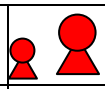
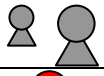
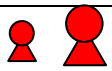
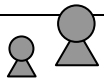
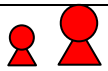
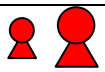
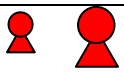
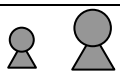
As evident in the table above, for both age groups objectives relating to the acquisition of content knowledge are highly prioritized both in curriculum documents and in formal assessment. The development of scientific skills may be evident in policy declarations but not prioritized in assessment, while the acquisition of values is neither evident in policy documents nor prioritized in students' assessment.

Probable implications to the project:

- RRI related objective do not seem to be of high priority in the country, as evident both in the envisioned curriculum and in students' expected and assessed outcomes; this might be ***a hindering factor need to be taken into consideration in the process of engaging sciences teachers in implementing in the classrooms resources that relate to RRI objectives.***

4. 8.3. Curriculum Content and RRI (socio-scientific issues, technology, values, nature of science) – Norway

This section aims to provide an understanding on whether or not (and up to what degree) themes relating to socio-scientific issues, technology, values, nature of science are evident and prioritized in the curriculum of the country.

Curriculum content in the areas of			*Not Evident*	*Evident but not prioritized*	*Evident and prioritized*
	…socio-scientific issues	Curriculum			
		Assesment			
		Teacher training			
	…technology	Curriculum			
		Assesment			
		Teacher training			
	… values	Curriculum			
		Assesment			
		Teacher training			
	…nature of science	Curriculum			
		Assesment			
		Teacher Training			

 **Students 11-14 years old**

 **Students 14-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

As reported by the Norwegian partners, content relating to RRI teaching evident in the envisioned curriculum is mainly evident but not prioritized. Issues on biotechnology and environmental protection are evident for age group 15-16 years old. Of high priority are themes relating to the nature of science for all age groups as "the building researcher" is one of the 5-6 main subject areas for ages 6-16. Content relating to RRI is not evident to students' assessment, while it is evident but not prioritized in teacher training programmes.

Probable implications to the project:

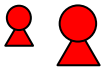
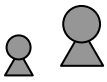
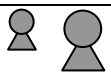
- ***Content relating to RRI teaching is mainly not evident in the science curriculum.*** This might be a ***hindering factor*** for engaging big numbers of science teachers to implement ENGAGE RRI materials in the classrooms, especially if there is not much autonomy for teachers in the country to implement extra curriculum activities.

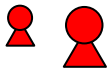
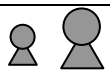
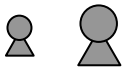
- ***In the process of localization and dissemination*** of the project recourses, materials ***associated with nature of science should preferred*** as they seem to be more relevant and associated with the science curriculum content in the country.

- Themes relating to socio-scientific issues, technology, values, nature of science are evident but not prioritized both in in-service and pre-service teacher training, indicating ***that teachers' content background on the area might be limited.*** ENGAGE workshops and online courses on teacher training of RRI materials may prove particularly helpful in this regard.

4. 8.4. Pedagogical processes and RRI – Norway

The tables below show whether or not pedagogical strategies such as IBL and argumentation (that relate to RRI objectives) are evident and prioritized in the country.

Inquiry-Based Learning				
	…the envisioned curriculum			
	….teacher training			
		Not evident	***Evident but not prioritized***	***Evident and prioritized***
	….in the classrooms			
		Not frequently implemented	***Frequently implemented***	

Argumentation				
	…the envisioned curriculum			
	….teacher training			
		Not evident	***Evident but not prioritized***	***Evident and prioritized***
	….in the classrooms			
		Not frequently implemented	***Frequently implemented***	

 **Students 11-12 years old**

 **Pre-service teachers**

 **Students 13-16 years old**

 **In-Service teachers**

As evident in the tables above, both inquiry-based learning and argumentation are evident in the envisioned curriculum, with inquiry based learning being also prioritized. Inquiry based learning is also evident in teachers professional development, indicating that teachers are adequately familiarized with the methodology. In contrast, argumentation is not part of

teachers training both for in-service and pre-service teachers. Nevertheless, as reported by the Norwegian partners both methodologies are not frequently been implemented in the classrooms.

Probable implications to the project:

- There is ***rather fruitful educational context*** in the country for the aims of the ENGAGE project ***in terms the degree to which inquiry based learning is prioritized in the country and in terms of familiarization of teachers in the methodology.***
- In contrast, teachers do not seem to be familiar with the notion of argumentation. ***Specific guidelines on implementing argumentation would particularly benefit the accomplishment of the aims of the project in the country***.
- Both ***inquiry based learning*** and ***argumentation are*** not frequently implemented in the classrooms for all age groups. In case ***time constrains*** is a reason for not frequent use of RRI methodologies in the classrooms – as in other countries-, it ***should be taken into account for the development of guidelines for using the resources in the classroom*** - maybe the principle "less is more" in the development of the resources, would allow time for students to engage in argumentative discourse and inquiry.

4. 8.5. Context (informal settings, society) and RRI – Norway

In this section, we seek to gain an understanding on the degree to which there are connections between schools and informal setting with an aim to support RRI objectives, as well as on the degree on which the broader societal communities – in which students are active members- are aware of and support RRI initiatives. Information provided aims to facilitate dissemination work and the process of engaging informal educational providers in the project in the country.

Actors that promote RRI initiatives	Examples on how RRI initiatives are promoted

Actors that implement RRI initiatives	Implementation as part of …			
	…the national strategy	…school mission	…teaching strategy	Other (please explain)

(Input is still needed by Norwegian Partners)

Connections between schools and informal education providers			
	Not Evident	***Evident but not prioritized***	***Evident and prioritized***

 **Primary schools**

 **General secondary schools**

 **Vocational Schools**

4. 8.6. Probable barriers and opportunities to the project

In the light of the analysis of the science curriculum in Norway that was presented in the previous sections, the following issues that emerge might have implications in various levels within the ENGAGE project:

Probable Barriers:

- RRI related objective do not seem to be of high priority in the country, as evident both in the envisioned curriculum and in students' expected and assessed outcomes; this might be ***a hindering factor need to be taken into consideration in the process of engaging sciences teachers in implementing in the classrooms resources that relate to RRI objectives.***

- ***Content relating to RRI teaching is*** present in the curriculum, but not prioritized in a real way**..** This might be a ***hindering factor*** for engaging big numbers of science teachers to implement ENGAGE RRI materials in the classrooms, especially if there is not much autonomy for teachers in the country to implement extra curriculum activities.

- Themes relating to socio-scientific issues, technology, values, nature of science are evident but not prioritized both in in-service and pre-service teacher training, indicating ***that teachers' content background on the area might be limited.*** ENGAGE workshops and online courses on teacher training of RRI materials may prove particularly helpful in this regard.

- Teachers do not seem to be familiar with the notion of argumentation. ***Specific guidelines on implementing argumentation would particularly benefit the accomplishment of the aims of the project in the country***.

  According to comments of the Norwegian partners in the process of verification the outcomes of the analysis, this is an important point that teachers are usually not very proficient in argumentation, especially in scientific subjects. The curriculum does emphasize argumentation as a topic across ALL subjects, but schools/teachers need to work on the implementation of these skills through the next few years.

- Both ***inquiry based learning*** and ***argumentation are*** not frequently implemented in the classrooms for all age groups. In case ***time constrains*** is a reason for not frequent use of RRI methodologies in the classrooms – as in other countries-, it ***should be taken into account for the development of guidelines for using the resources in the classroom*** - maybe the principle "less is more" in the development of the resources, would allow time for students to engage in argumentative discourse and inquiry

Probable opportunities:

- For the Norwegian educational context and for age groups 11-16, ***resources dealing with multidisciplinary issues*** should be preferred to resources relating to particular disciplines (physics, biology, chemistry).

- ***In the process of localization and dissemination*** of the project recourses, materials ***associated with nature of science should preferred*** as they seem to be more relevant and associated with the science curriculum content in the country.

- There is ***rather fruitful educational context*** in the country for the aims of the ENGAGE project ***in terms the degree to which inquiry based learning is prioritized in the country and in terms of familiarization of teachers in the methodology.*** According to comments of the Norwegian partners in the verification process of the outcomes of the report, hopefully this is partly true, but there is clearly a need for schools to work also on the implementation of inquiry based learning.

References:

National science curriculum in English:
http://www.udir.no/kl06/NAT1-03/Hele/?lplang=eng

White paper on teacher education:
http://www.regjeringen.no/en/dep/kd/Documents/Brochures-and-handbooks/2009/factsheet-white-paper-on-teacher-educati.html?id=545075

4. 9. RRI Curriculum Analysis for the case of Switzerland

4.9.0. Background - Switzerland

The educational system in Switzerland is very diverse, because the constitution of Switzerland delegates the authority for the school system mainly to the cantons. The Swiss constitution sets the foundations, namely that primary school is obligatory for every child and is free in public schools and that the confederation can run or support universities. The minimum age for primary school is about six years in all cantons but Obwalden, where it is five years and three months. After primary schools, the pupils split up according to their abilities and intentions of career paths. Roughly 20% of all students attend secondary schools leading, normally after 12 school years in total to the federal recognized matura which grants access to all universities. The other students split in two or more school-types (depends on the canton) differing in the balance of theoretical and practical education. It is obligatory for all children to attend school for at least 9 years.

In terms of how science is taught at the different levels, it is mainly multidisciplinary for 11-12 years old student, and mainly disciplinary for 13-16 years old.

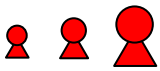
Probable implications to the project:

- The way science is taught in the country should be taken into consideration ***In the process of localization and dissemination*** of the project's curriculum materials/recourses. For age groups 11-12, ***resources dealing with interdisciplinary issues*** should be preferred to resources relating to particular disciplines (physics, biology, chemistry); for age groups 13-16 years old recourses relating to each discipline might be more engaging for teachers.

- The fact that the ***educational system in the country is very diverse***, and ***not centralized*** should be taken into consideration in the process of dissemination of the recourses and of engaging science teachers in the project.

4. 9.1. Recent curriculum changes in relation to RRI - Switzerland

The table below provides an indication on the degree to which aspects of RRI philosophy are (or are not) emerging in current or envisioned educational changes –-where evident - both in policy and in educational practice.

Changes relating to					
	…the envisioned curriculum				
	…the enacted curriculum				
	….teacher training				
		No change	***Not in line with RRI***	***Partly in line with RRI***	***In line with RRI***

 **Students 11-12 years old**

 **Students 13-15 years old**

 **Students 15-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

In terms of the science envisioned curriculum changes are taking place for the age groups 11-12 and 13-15 years old, which are mainly in line with RRI philosophy. Indeed, as reported by our partners in the country, for age group 11-12 years old, there is a focus on education for sustainable development, which is the main goal for education. Such a goal needs an interdisciplinary approach in science teaching, with development of critical thinking and values. Teachers for this age group have a generalist formation. For the age group 13-15, the theoretical approach is the same, but the teachers are specialists of one discipline.

In relation to teacher training, it depends of the canton, and is not the same for primary (children between 11-12 years old), secondary I (12-15 years old) and secondary II (15-16 years old). Aspects of RRI that are evident at primary level in Fribourg are the following: inquiry teaching, use of ICT, promoting the development of thinking skills, philosophy, reflection between religion and science, epistemology of science, and start to develop the interdisciplinary.

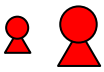
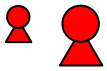
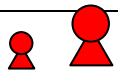
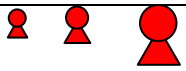
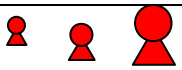
Finally, as far as the enacted science curriculum is concerned, current changes for age group 11-15 are partly in line with RRI, following the recommendations of the envisioned curriculum.

Probable implications to the project:

- Current reforms in science curriculum – in which aspects of RRI are evident – indicate that ***there is an opportunity for ENGAGE to have an actual impact in the country, by facilitating the transformation of policy envisions to classroom implementation***.

4. 9.2. Curriculum objectives and expected outcomes in relation to RRI - Switzerland

The table below illustrates the prioritized objectives that are evident in the curriculum and in the formal assessment in the country.

Objectives and outcomes prioritized					
	Acquisition of scientific knowledge	*Policy documents*			
		Formal assessment			
	Development of scientific skills	*Policy documents*			
		Formal assessment			
	Acquisition of Values	*Policy documents*			
		Formal assessment			
			Not a priority	***Medium Priority***	***High Priority***

 **Students 11-12 years old**  **Students 13-15 years old**  **Students 15-16 years old**

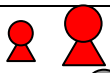
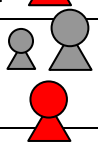
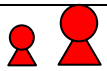
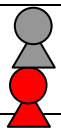
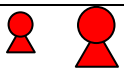
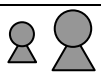
As evident in the table above, there seems to be in accordance in the country between the prioritized objectives in the curriculum and in assessment. As reported by the partners in Switzerland, the prioritized science objectives are partly in line with RRI philosophy, especially if "Formation Générale" is activated in teaching which focuses on high sensible society questions. It should be notes though that the objective of students' acquisition of values is not a priority in science documents and formal assessment.

Probable implications to the project:

- In Switzerland, the prioritized science objectives are partly in line with RRI philosophy, providing a rather fruitful context for the accomplishment of the project's objectives.

4. 9.3. Curriculum Content and RRI (socio-scientific issues, technology, values, nature of science) - Switzerland

This section aims to provide an understanding on whether or not (and up to what degree) themes relating to socio-scientific issues, technology, values, nature of science are evident and prioritized in the curriculum of the country.

Curriculum content in the areas of	***…socio-scientific issues***	Curriculum			
		Assesment			
		Teacher training			
	…technology	Curriculum			
		Assesment			
		Teacher training			
	… values	Curriculum			
		Assesment			
		Teacher training			
	…nature of science	Curriculum			
		Assesment			
		Teacher Training			
			Not Evident	***Evident but not prioritized***	***Evident and prioritized***

 **Students 11-14 years old**

 **Students 15-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

As evident in the table above most of the thematic relating to RRI is not evident to science curriculum for age group 15-16. In contrast, themes relating to RRI for age group 11-14 years old may be evident but not prioritized in the curriculum (socio-scientific issues, technology, values and nature of science). Indeed as stated by our partners in the country, and relation to socio-scientific issues, there is always a gap between sciences (biology, chemistry, physic) and social sciences (philosophy, geography, history…). The interdisciplinary start only at 16-17 years old and with a restrictive view (interdisciplinary between biology, chemistry and physics or between social-sciences: history and geography, eventually philosophy). In terms of teacher training, the content depends on the institution and on the cantons. In Fribourg just one course with sciences roots has an RRI approach. Students have choice between different interdisciplinary propositions, and some of them have an RRI issue. In these examples, there are also values, nature of science. A same approach appears in Lausanne, for the secondary teachers I. In Fribourg, the preparation for teaching sciences in secondary II proposes an transdisciplinary approach. No is no specific information for Vaud, Neuchâtel, Berne. For secondary II, the formation is done on a HEP or directly in the university: the curricula are very different.

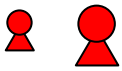
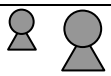
Probable implications to the project:

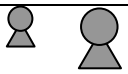
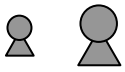
- ***In terms of content resources targeting age group 11-14 are more likely to be implemented in the classrooms*** that those targeting 15-16, due to the fact that they RRI content is more evident in the former case than the latter.

- Themes relating to socio-scientific issues, technology, values, nature of science are evident but not prioritized both in in-service and pre-service teacher training, indicating ***that teachers' content background on the area might be limited.*** ENGAGE workshops and online courses on teacher training of RRI materials may prove particularly helpful in this regard.

4. 9.4. Pedagogical processes and RRI - Switzerland

The tables below show whether or not pedagogical strategies such as IBL and argumentation (that relate to RRI objectives) are evident and prioritized in the country.

Inquiry-Based Learning	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

Argumentation	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

 **Students 11-12 years old**

 **Pre-service teachers**

 **Students 13-16 years old**

 **In-Service teachers**

As evident in the tables above, neither inquiry based learning nor argumentation are evident in curriculum documents. In addition there are not frequently implemented in the classrooms, and are mainly not evident in teachers training (with an exception of inquiry based learning for pre-service teachers, which is evident but not prioritized in training

programmes). In terms of argumentation, as reported by our partners, argumentation is mainly understood as a language skill and the link with science is not evident.

Probable implications to the project:

- Teachers in Switzerland do not seem to be familiar with pedagogies relating to RRI objectives. ***Specific guidelines on implementing argumentation would particularly benefit the accomplishment of the aims of the project in the country***.

4. 9.5. Context (informal settings, society) and RRI - Switzerland

In this section, we seek to gain an understanding on the degree to which there are connections between schools and informal setting with an aim to support RRI objectives, as well as on the degree on which the broader societal communities – in which students are active members- are aware of and support RRI initiatives. Information provided aims to facilitate dissemination work and the process of engaging informal educational providers in the project in the country.

Actors that promote RRI initiatives	Examples on how RRI initiatives are promoted
Some teachers in the HEP Fribourg	http://vudemaclasse.friportail.ch/ http://philoecole.friportail.ch/
LirEDD from HEP Vaud	http://www.hepl.ch/cms/accueil/recherche/laboratoires-hep-vaud.html
L. Dubois, LDES, Uni de Genève	http://cms.unige.ch/ldes/?page_id=52
Education 21, national agency for sustainable development: for example, the “Mystery” game:	http://www.education21.ch/fr/ecole/moyens-denseignement

Actors that implement RRI initiatives	Implementation as part of …			
	…the national strategy	…school mission	…teaching strategy	Other (please explain)
The main HEP and University in the French part of Switzerland are partners for implementation: HEP Fribourg (primary teachers) HEP BEJUNE (primary and secondary I & II) HEP VD (secondary I) Université de Fribourg (secondary I) Université de Genève (primary)	With the PER for primary and secondary I school		Some very good teachers	National Agency for education for sustainable development: Education 21

Connections between schools and informal education providers			
	Not Evident	***Evident but not prioritized***	***Evident and prioritized***

 **Primary schools**

 **General secondary schools**

4. 9.6. Probable barriers and opportunities to the project

In the light of the analysis of the science curriculum in Switzerland that was presented in the previous sections, the following issues that emerge might have implications in various levels within the ENGAGE project:

Probable Barriers:

- The fact that the ***educational system in the country is very diverse*** might be a hindering factor in the process of targeted dissemination of the recourses.

- Themes relating to socio-scientific issues, technology, values, nature of science are evident but not prioritized both in in-service and pre-service teacher training, indicating ***that teachers' content background on the area might be limited.*** ENGAGE workshops and online courses on teacher training of RRI materials may prove particularly helpful in this regard.

- Teachers in Switzerland do not seem to be familiar with pedagogies relating to RRI objectives. ***Specific guidelines on implementing argumentation would particularly benefit the accomplishment of the aims of the project in the country***.

Probable opportunities:

- The way science is taught in the country should be taken into consideration ***In the process of localization and dissemination*** of the project's curriculum materials/recourses. For age groups 11-12, ***resources dealing with interdisciplinary issues*** should be preferred to resources relating to particular disciplines (physics, biology, chemistry); for age groups 13-16 years old recourses relating to each discipline might be more engaging for teachers.

- Current reforms in science curriculum – in which aspects of RRI are evident – indicate that ***there is an opportunity for ENGAGE to have an actual impact in the country, by facilitating the transformation of policy envisions to classroom implementation***.

- In Switzerland, the ***prioritized science objectives*** are partly in line with RRI philosophy, providing a ***rather fruitful context*** for the accomplishment of the project's objectives.

- ***In terms of content, resources targeting age group 11-14 are more likely to be implemented in the classrooms*** that those targeting 15-16, due to the fact that they RRI content is more evident in the former case than the latter.

4. 10. RRI Curriculum Analysis for the case of Lithuania

4. 10.0. Background - Lithuania

The Lithuanian educational system is organized as follows: Formal education begins at the age of 6 - 7, with primary school lasting for 4 year. The 4-year primary school is followed by 6 years of basic education. If a pupil is successful in the final examination, this concludes with a basic education certificate (the equivalent of the intermediate school leaving certificate in Germany). After completion of basic education, a two-year course of upper secondary education may be embarked upon. It is also possible to transfer to an upper secondary school upon completion of class 8, this school then continuing until class 12. In classes 11 and 12, pupils are permitted to select subjects in a targeted way in accordance with their personal interests and strengths.

In terms of science education and the way it is taught in the country, for students age 7-10 years old (primary school) science is mainly taught in an interdisciplinary way; this is also the case for lower secondary school in respect to students' age 11-12 years old; in contrast, for lower secondary level for students' age 13-16 science is mainly disciplinary (i.e. biology or chemistry or physics).

Probable implications to the project:

- ***In the process of localization and dissemination*** of the project's curriculum materials/recourses in the country, the way science is taught should be taken into consideration. For ***age group 11-12, resources dealing with interdisciplinary issues*** might be more relevant to the educational context; ***for age group 13-16 materials with content addressing a specific discipline*** should be preferred for dissemination to resources in interdisciplinary format.

10.1. Recent curriculum changes in relation to RRI

The table below provides an indication on the degree to which aspects of RRI philosophy are (or are not) emerging in current or envisioned educational changes -if evident - both in policy and in educational practice.

Changes relating to		*No change*	*Not in line with RRI*	*Partly in line with RRI*	*In line with RRI*
	…the envisioned curriculum				
	…the enacted curriculum				
	….teacher training				

 **Students 11-12 years old**

 **Pre-service teachers**

 **Students 13-16 years old**

 **In-Service teachers**

In the Lithuanian educational context, there are no current changes in policy declarations in relation to science curriculum. In should be noted though that at the moment there is much debate for age group 12-13 years old on the transition from disciplinary sciences teaching to integrated science. At the one end of the spectrum of the debate, education policies are convinced that is necessary to teach science as an integrated subject, while at the other end teacher trainers and teachers are not convinced with the proposal.

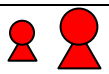
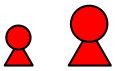
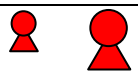
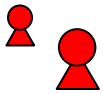
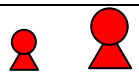
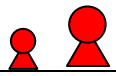
Nevertheless, in contrast to the envisioned curriculum where no changes have taken place for the last 3 years, changes in the way science is taught in the classrooms are evident and partly in line with RRI philosophy. Indeed, as reported by the Lithuanian partners, textbooks are being updated by their authors, the training centres in the country organize teacher training workshops, and much attention is given to the integration of socio-cultural aspects in the curriculum, textbooks and educational practice. Changes in favour of the wider uptake of RRI teaching in the country are also evident in teacher training programmes: in pre-service teachers' training for example the S-TEAM project of the 7th framework that was carried out at the Lithuanian University of Educational Science engaged many pre-service teachers. The main idea of the project was interdisciplinary and socio-cultural integration, which responds to RRI aspects. For in-service teachers, the Lithuanian University of Educational Science organizes science teachers training on socio-cultural and cross-curricular integration.

Probable implications to the project:

- There is ***a fruitful educational context*** in the country for the aims of the ENGAGE project in terms of recent changes both in the envisioned science ***curriculum is implemented in the classrooms*** and in ***teacher training programmes***. The project should particularly take advantage of and built on current efforts in this country to introduce and implement aspects of RRI teaching in science education, by making contacts with and engage relevant actors.

4. 10.2. Curriculum objectives and expected outcomes in relation to RRI – Lithuania

In Lithuania, in terms of science curriculum objectives as evident in curriculum documents, highly prioritized are objectives that relate to the acquisition of values and to a lesser degree to the development of scientific skills. In contrast to many countries covered in this report, the acquisition of scientific knowledge does not seem to be of policy priority. The above indicate that curriculum objectives are in line with RRI philosophy both for age group 11-12 years old and for students 13-16 years old, as the focus mainly lies on the integration of socio-cultural aspects of the curriculum, textbooks and educational practice. In terms of expecting outcomes, there seems to be compatibility between the envisioned objectives and what is assed in the exams. The fact that the main focus of formal assessment is put on the acquisition of values and not on the acquisition of content knowledge is an indication that in this country there are no obvious barriers for the accomplishment of the project goals in terms of assessment. The following table summarizes information for the country in terms of the prioritized objectives in the science curriculum and in the formal assessment.

Objectives and outcomes prioritized	***Acquisition of scientific knowledge***	*Policy documents*			
		Formal assessment			
	Development of scientific skills	*Policy documents*			
		Formal assessment			
	Acquisition of Values	*Policy documents*			
		Formal assessment			
			Not a priority	***Medium Priority***	***High Priority***

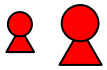
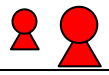
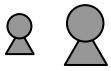
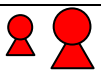
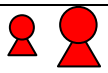
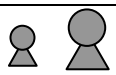
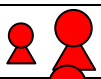
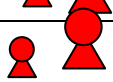
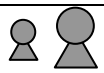
 **Students 11-12 years old**  **Students 13-16 years old**

Probable implications to the project:

- ***No obvious barriers*** for the accomplishment of the project goals are evident in the country ***in terms of the prioritized curriculum objectives*** and ***the students expected outcomes.***

4. 10.3. Curriculum Content and RRI (socio-scientific issues, technology, values, nature of science) – Lithuania

This section aims to provide an understanding on whether or not (and up to what degree) themes relating to socio-scientific issues, technology, values, nature of science are evident and prioritized in the science curriculum of the country.

Curriculum content in the areas of	***…socio-scientific issues***	Curriculum			
		Assesment			
		Teacher training			
	…technology	Curriculum			
		Assesment			
		Teacher training			
	… values	Curriculum			
		Assesment			
		Teacher training			
	…nature of science	Curriculum			
		Assesment			
		Teacher Training			
			Not Evident	***Evident but not prioritized***	***Evident and prioritized***

 **Students 11-12 years old**

 **Students 13-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

As evident in the table above, thematic areas that are more evident and prioritized in the curriculum – that relate to RRI in the country – are socio-scientific issues and values for both age groups. In relation to socio-scientific issues, as reported by the Lithuanian partners, the curriculum of Science education for secondary school is oriented towards developing the ability of students to understand human-induced changes in the nature and to take personal responsibility for the preservation of environment and conserve their own and other people's health. According to the Science education program (2008), the natural knowledge has a significant impact on the social, political and economic life. In relation to values, thematic areas of the curriculum that relate to the theme are the following: for students age 11-12, the life continuity and diversity (nature sciences– integrated curriculum) where the students get interested in the origin of life; for students 13-14 years old, The biosphere and the people (biology), where the students take an interest in protecting wildlife and seek to apply knowledge about life in practice; for students 14-16 years old, movement and energy (physics), where it is important to fostered responsibility of students for nature conservation and the rational use of resources.

Content relating to technology and nature of science is evident but not of high priority in the science curriculum. In relation to technology, thematic areas of the curriculum that relate to the theme are the following: for students age 11-12, Earth and Universe (nature sciences – integrated curriculum). Solar system is analysed using the models and computer programs. Whenever possible, it is useful to organize excursions to the planetarium, the observatory, the Ethnocosmology centre. For students 12-14 years old, Energy and knowledge of the physical processes (physics) where students analyse and evaluate the family electricity costs. They are looking for information about energy saving techniques in various resources of information. The students acquire knowledge about energy efficiency and explore the ways of practically saving energy. Finally for students 14-16 years old, movement and energy (physics) where the students analyse the laws of motion and their application in science, technology in everyday life, and to rely on them in various activities. In relation to thematic on nature of science thematic areas of the curriculum that relate to the theme are the following: for students age 11-12, the biosphere and people (nature sciences – integrated curriculum), where the students describe various land-based organic and inorganic wastes and the pollution reduction methods (sorting and compost production). For students 12-14 years old, Energy and physical process (physics), where the students analyse examples of energy transformations: the transition of food energy into movement energy, the transitions of fuel energy into the car's movement energy and so on. Finally for students 14-16 years old, Energy and physical process (physics), where the students formulate the energy endurance law; give examples of the law in the nature, everyday life and technique.

Although curriculum content in the country seems to be in favour of prioritizing RRI relating themes, in terms of RRI content that emerges in students' assessment it is only nature of science thematic that seems to be evident. In general, there are three levels of student achievements: low (5-6), intermediate (7-8 points), high (9-10 points) in all science programs (biology, physics, chemistry). *Low level*: the knowledge of Natural world very superficial. The natural sciences concepts are non-targeted. *Intermediate level*: The students have knowledge about natural world and inanimate nature. The students sometimes correctly use natural science concepts. *High level*: The students demonstrate basic understanding of the natural world and inanimate nature. They apply and properly use the concepts of natural science. As reported by the Lithuanian partners, there are no prioritized themes relating on sciences issues in students' assessment. There are no evident themes relation to socio-

scientific issues, technology and values in formal assessment. Specifically for values, they are not evaluated by marks. It is important to develop students' interest in science, and respect for the natural world and inanimate world, it is important to foster their responsibility for natural world.

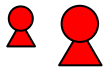
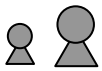
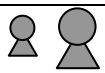
Finally, in relation to teacher training programmes, themes on socio-scientific issues, technology, and nature of science is evident but not prioritized. In terms of technology, there is a lack of great emphasis on new technological solutions and of the link between research, technological innovation and educational practice. As for content on values, it was reported that although there is a strong focus on students' values in the education programs, in the educational documents, there is a lack of specific proposals how to achieve this in the educational practice.

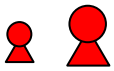
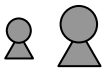
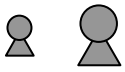
Probable implications to the project:

- ***For students 11-16, resources relating to the socio-scientific issues and values are more likely to be implemented in the classrooms*** due to the fact that they such content is evident and prioritized in the curriculum of the country. Content relating to ***technology and nature of science is also evident in the curriculum***, therefore be of interest of some teachers, however it is highly prioritized.
- Themes relating to ***socio-scientific issues, technology, and nature of science*** are evident but not prioritized both in in-service and pre-service teacher training, indicating ***that teachers' content background on the area might be limited.*** ENGAGE workshops and online courses on teacher training of RRI materials may prove particularly helpful in this regard.
- For ***themes relating to values*** -although there is a strong focus on the field in the education programs - ***there is a lack of specific proposals in educational document on how to achieve this in the educational practice***. This is an ***opportunity*** for the project to fill this gap, by the ***provision of appropriate guidelines to teachers and teaching strategies*** on how to address and implement RRI thematic on values in the classroom.
- Although there is a focus in the country on RRI thematic in the curriculum, according themes are not evident in students' formal assessment. In the case that RRI content is ***inadequately assessed in formal assessment in the country, this might be a barrier*** for the accomplishment of the project's objectives; ***specific guidelines to the teachers on how RRI objectives can be assessed*** – along with guidelines on implementation of RRI strategies – would benefit the broader uptake of the project' s recourses and materials

4. 10.4. Pedagogical processes and RRI – Lithuania

The tables below show whether or not pedagogical strategies such as IBL and argumentation (that relate to RRI objectives) are evident and prioritized in the country.

Inquiry-Based Learning	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

Argumentation	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

 **Students 11-12 years old**

 **Pre-service teachers**

 **Students 13-16 years old**

 **In-Service teachers**

As reported by the Lithuanian partners, both inquiry based methods and argumentation might be evident but not prioritized in the envisioned curriculum. In terms of the envisioned curriculum, there is a mandatory chapter named Research in science that is related to

inquiry based learning, while natural sciences curriculum provide to develop students problem solving and communication competences, which relate to the argumentation. In terms of pre-service teachers' training, the Lithuanian University of Educational Science prepare pre-service teachers to apply inquiry in educational practice. They analyse the peculiarities of the real, the virtual and the digital experiment and they participated in an international project S-TEAM, which based on inquiry based learning. As for in-service teacher training, there are many workshops for teachers about the application of inquiry based learning in educational practice. Lithuanian teachers can use the virtual experimental platforms (http://mkp.emokykla.lt/gamta5-6/lt/mo/demonstracijos/), educational materials (http://www.youtube.com/watch?v=G5MtT2vnrfQ) and other tools. This is also the case for argumentation: there are many workshops for teachers about the argumentation in educational practice. Lithuanian teachers can use the argumentation based on virtual platforms such as http://www.ugdome.lt/kompetencijos5-8/pagrindinis/pagrindiniai-kompetenciju-ugdymo-aspektai/siuolaikinio-ugdymo-tikslas-asmens-kompetencijos/bendrosios-ir-esmines-dalykines-kompetencijos/, educational materials (http://www.youtube.com/user/ProjektasMOBIK/featured) and other tools.

It should be noted though that neither inquiry based learning, nor argumentation seems to be frequently practiced in the classroom – information that as reported by the partners is not based on research based data but in their professional experience. The reasons for not frequent implementation of such methodologies in the country should be further elaborated, in order teachers are to be facilitated in practice in implementing ENGAGE RRI resources.

Probable implications to the project:

- Teachers in Lithuania seem to be ***adequately familiarized with teaching methods that support RRI teaching and learning*** – such as inquiry based learning and argumentation.

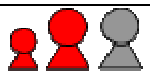
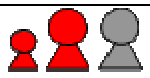
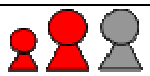
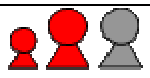
- Attention should be turned though to the fact that such methodologies are not frequently been implemented in the classrooms: ***more investigation is needed on the reasons for not frequent implementation of such methodologies in the country, in order teachers are to be facilitated in practice in implementing ENGAGE RRI resources.***

4. 10.5. Context (informal settings, society) and RRI – Lithuania

In this section, we seek to gain an understanding on the degree to which there are connections between schools and informal setting with an aim to support RRI objectives, as well as on the degree on which the broader societal communities – in which students are active members- are aware of and support RRI initiatives. Information provided aims to facilitate dissemination work and the process of engaging informal educational providers in the project in the country

Actors that promote RRI initiatives	Examples on how RRI initiatives are promoted
Museums	Exhibitions are prepared
Lithuanian Informal Training Center	After obtaining grants for temporary projects
NGOs	Temporary activities; After obtaining grants for temporary projects
Education Development Center	Implements projects related to the improvement of education

Actors that implement RRI initiatives	Implementation as part of …			
	…the national strategy	…school mission	…teaching strategy	Other (please explain)
Museums			+	
Lithuanian Informal Training Center			+	
NGOs			+	
Education Development Center	+	+	+	

Connections between schools and informal education providers			
	Not Evident	***Evident but not prioritized***	***Evident and prioritized***
Museums			
Lithuanian Informal Training Centre			
NGOs			
Education Development Centre			

Primary schools

General secondary schools

Vocational Schools

4. 10.6. Probable barriers and opportunities to the project- Lithuania

In the light of the analysis of the science curriculum in Lithuania that was presented in the previous sections, the following issues that emerge might have implications in various levels within the ENGAGE project:

Probable Barriers:

- Themes relating to ***socio-scientific issues, technology, and nature of science*** are evident but not prioritized both in in-service and pre-service teacher training, indicating ***that teachers' content background on the area might be limited.*** ENGAGE workshops and online courses on teacher training of RRI materials may prove particularly helpful in this regard.
- For ***themes relating to values*** -although there is a strong focus on the field in the education programs - ***there is a lack of specific proposals in educational document on how to achieve this in the educational practice***. This might be ***a barrier*** but also an ***opportunity*** for the project to fill this gap, by the ***provision of appropriate guidelines to teachers and teaching strategies*** on how to address and implement RRI thematic on values in the classroom.
- Although there is a focus in the country on RRI thematic in the curriculum, according themes are not evident in students' formal assessment. In the case that RRI content is ***inadequately assessed in formal assessment in the country, this might be a barrier*** for the accomplishment of the project's objectives; ***specific guidelines to the teachers on how RRI objectives can be assessed*** – along with guidelines on implementation of RRI strategies – would benefit the broader uptake of the project' s recourses and materials

- RRI related teaching methodologies are not frequently been implemented in the classrooms: ***more investigation is needed on the reasons for not frequent implementation of such methodologies in the country, in order teachers are to be facilitated in practice in implementing ENGAGE RRI resources***

Probable Opportunities:

- The project should particularly take advantage of and built on current efforts in this country to introduce and implement aspects of RRI teaching in science education, by making contacts with and engage relevant actors. Indeed, there is ***a fruitful educational context*** in the country for the aims of the ENGAGE project in terms of recent changes both in the envisioned science ***curriculum is implemented in the classrooms*** and in ***teacher training programmes***.

- Given the way science is taught, for ***age group 11-12, resources dealing with interdisciplinary issues*** might be more relevant to the educational context; ***for age group 13-16 materials with content addressing a specific discipline*** should be preferred for dissemination to resources in interdisciplinary format. The above can

facilitate ***In the process of localization and dissemination*** of the project's curriculum materials/recourses in the country.

- ***For students 11-16, resources relating to the socio-scientific issues and values are more likely to be implemented in the classrooms*** due to the fact that they such content is evident and prioritized in the curriculum of the country. Content relating to ***technology and nature of science is also evident in the curriculum***, therefore be of interest of some teachers, however it is highly prioritized.

- Teachers in Lithuania seem to be ***adequately familiarized with teaching methods that support RRI teaching and learning such as inquiry based learning and argumentation.***

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4. 11. RRI Curriculum Analysis for the case of Cyprus

4. 11.0. Background – Cyprus

Education in Cyprus is under the supervision of the Ministry of Education and Culture. The organization and structure of the Cyprus educational system, as have been shaped since the formation of the Cypriot state resemble those of the Greek system. Specifically, it has the following general levels: Primary Education (Pre-primary & primary education, 3-5 and 6-12 years old accordingly); Secondary Education (Gymnasium & Lyceum, 12-15 and 15-18 years old accordingly); Higher Education (Higher & Tertiary Education).

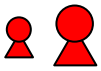
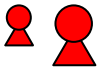
In relation to science education and the way it is taught for each age group, for students age 11-12 (upper elementary science) it is mainly interdisciplinary, with an emphasis on topics from physics and environmental education); for age 13-15 (middle school) it is also multidisciplinary (physics and "Fysiognostika", which include biology and chemistry topics and the two main topics); for age 15-16 (high-school) science is mainly disciplinary (i.e. biology, chemistry, or physics).

Probable implications to the project:

- The way science is taught in the country should be taken into consideration ***In the process of localization and dissemination*** of the project's curriculum materials/recourses. For ***age group 11-15, resources dealing with multidisciplinary issues*** might be more relevant to the educational context; ***for age group 15-16 materials with content addressing a specific discipline*** should be preferred to resources in multidisciplinary format.

4. 11.1. Recent curriculum changes in relation to RRI – Cyprus

The table below provides an indication on the degree to which aspects of RRI philosophy are (or are not) emerging in current or envisioned educational changes –-where evident - both in policy and in educational practice.

Changes relating to					
	…the envisioned curriculum				
	…the enacted curriculum				
	….teacher training				
		No change	***Not in line with RRI***	***Partly in line with RRI***	***In line with RRI***

 **Students 11-12 years old**

 **Students 12-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

As reported by the partners of Cyprus, the science curriculum was reformed -on paper- 3 years ago. The main change, which is partly in line with RRI philosophy, is that the new reform documents put an emphasis on the connection of science with everyday life. Especially for age group 12-16 years old, content on nature of science was introduced in the subject of Biology. Currently, the reforms are being implemented in the design of the books. Changes that are partly in line with RRI are also evident at in-service teacher training programmes: In-service teachers attended a day-seminar to inform them about the changes in the science curriculum. Furthermore, they can choose to attend seminars on science teaching (with an emphasis on the connection with everyday science); yet, it should be noted that these seminars are not compulsory for science teachers. In relation to the enacted curriculum, for all age levels there seem to be a move towards more RRI objectives: for students 11-12 years old changes are mostly associated with the connection of science to everyday life; for the age group 13-16 relevant to RRI changes mostly refer both to the association of science to everyday life and the introduction of the nature of science (in biology reforms).

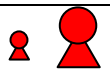
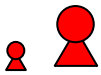
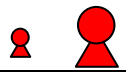
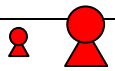
Probable implications to the project:

- Reforms in science curriculum – in which aspects of RRI are evident - initiated three years ago and are currently at the level of reforming science textbook and gradually at classroom implementation. ***It is an opportunity for ENGAGE to have an actual impact in the country, by facilitating the transformation of policy envisions to classroom implementation***.

- Recently (in the last two weeks) there have been a lot of discussions about how teachers (across all educational levels) in Cyprus are evaluated. One of the proposed changes in the evaluation will account for teachers' participation in teacher professional development. This is ***an opportunity for ENGAGE to impact teacher professional development in the country***.

4. 11.2. Curriculum objectives and expected outcomes in relation to RRI – Cyprus

The table below illustrates the prioritized objectives that are evident in the curriculum and in the formal assessment in the country.

Objectives and outcomes prioritized	***Acquisition of scientific knowledge***	*Policy documents*			
		Formal assessment			
	Development of scientific skills	*Policy documents*			
		Formal assessment			
	Acquisition of Values	*Policy documents*			
		Formal assessment			
			Not a priority	***Medium Priority***	***High Priority***

 **Students 11-12 years old**  **Students 13-16 years old**

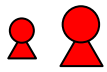
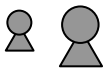
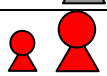
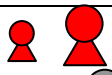
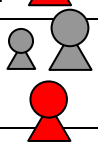
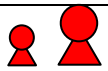
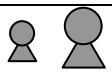
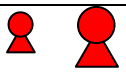
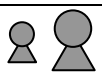
In the educational context of Cyprus, in terms of science curriculum objectives as evident in curriculum documents, highly prioritized are objectives that relate to the development of scientific skills, of medium priority objectives relating to the development of scientific skills, while the acquisition of values is not prioritized. As reported by the projects' partners of the country, in total the curriculum prioritized objectives seem to be partly in line with RRI goals, mostly being associated with the connection of science to everyday life and the introduction of nature of science (for age group 12-16 years old). However, it should be noted that the objective prioritized in students' assessment is mainly the acquisition of scientific knowledge and to a lesser degree the development of scientific skills, while the development of values are not evident. This might be a hindering factor for the accomplishment of the project, if we take into account that what is actually implemented in the classrooms is more close to goals evident in assessment than in policy declaration in the envisioned curriculum.

Probable implications to the project:

- With the assumption that assessment goals receive more attention than policy declarations in the envisioned curriculum by teachers, it seems that in the country content-base objectives are rather more prioritized in the country in comparison to objectives that are more RRI oriented (for example the acquisition of values); this might be ***a hindering factor need to be taken into consideration in the process of engaging sciences teachers in implementing in the classrooms resources that relate to RRI objectives. It will be useful if ENGAGE can highlight to teachers how improving RRI can also help improve content knowledge to convince teachers.***

4. 11.3. Curriculum Content and RRI (socio-scientific issues, technology, values, nature of science) – Cyprus

This section aims to provide an understanding on whether or not (and up to what degree) themes relating to socio-scientific issues, technology, values, nature of science are evident and prioritized in the curriculum of the country.

Curriculum content in the areas of	***…socio-scientific issues***	Curriculum			
		Assesment			
		Teacher training			
	…technology	Curriculum			
		Assesment			
		Teacher training			
	… values	Curriculum			
		Assesment			
		Teacher training			
	…nature of science	Curriculum			
		Assesment			
		Teacher Training			
			Not Evident	***Evident but not prioritized***	***Evident and prioritized***

 **Students 11-12 years old**

 **Students 12-16 years old**

 **Pre-service teachers**

 **In-Service teachers**

As evident in the table above, content relating to RRI teaching is mainly not evident in the science curriculum in Cyprus. Exception to this general picture is content relating to the nature of science for the age group 12-16 years old, mainly in the subject of biology, where there are many references to the history of science and the nature of scientific work. In relation to teacher training, RRI themes do not seem to be a part of training programs. However, it should be noted that there is not a common curriculum between the various institutions in Cyprus and the content covered depends on the institution that offers courses and professional development for teachers. For example at UNic, science in society is a part of teachers training programmes because of trainers personal and research interest.

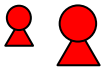
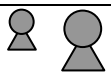
Probable implications to the project:

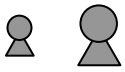
- ***Content relating to RRI teaching is mainly not evident in the science curriculum.*** This might be a ***hindering factor*** for engaging big numbers of science teachers to implement ENGAGE RRI materials in the classrooms, especially if there is not much autonomy for teachers in the country to implement extra curriculum activities.

- ***In the process of localization and dissemination*** of the project recourses, materials ***associated with nature of science should preferred*** as they seem to be more relevant and associated with the science curriculum content in the country.

4. 11.4. Pedagogical processes and RRI – Cyprus

The tables below show whether or not pedagogical strategies such as IBL and argumentation (that relate to RRI objectives) are evident and prioritized in the country.

Inquiry-Based Learning	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

Argumentation	*…the envisioned curriculum*			
	….teacher training			
		Not evident	*Evident but not prioritized*	*Evident and prioritized*
	….in the classrooms			
		Not frequently implemented	*Frequently implemented*	

 **Students 11-12 years old**

 **Pre-service teachers**

 **Students 13-16 years old**

 **In-Service teachers**

As shown in the first table above, inquiry-based leaning is evident and prioritized in the science curriculum of the country, as it has been the emphasis for all age groups since the previous reform. This is also the case as far as pre-service teacher training is concerned. In contrast inquiry based learning seems to be evident but not prioritized in in-service teacher

training. As reported by the partners of Cyprus, this difference might be attributed to the fact that pre-service training is conducted at universities (research institutions) whilst in-service is done by the ministry of education or the pedagogical institute in collaboration with the University of Cyprus (practitioners, and researchers). In addition the methodology is not frequently been implemented in the classrooms – depending on teachers' disposal. On the other hand argumentation is neither evident and prioritized in the curriculum nor frequently implemented in the classrooms. Indeed, as reported by our partners, most of the teachers are not familiar with the notion of argumentation. Yet, in pre-service teachers training programmes aspects of argumentation are part of the curriculum.

Probable implications to the project:

- There is ***a fruitful educational context*** in the country for the aims of the ENGAGE project ***in terms the degree to which inquiry based learning is prioritized in the last curriculum reform and in terms of familiarization of pre-service teachers in the methodology.***
- In contrast teachers do not seem to be familiar with the notion of argumentation. ***Specific guidelines on implementing argumentation would particularly benefit the accomplishment of the aims of the project in the country***.
- Both ***inquiry based learning*** and ***argumentation are*** not frequently implemented in the classrooms for all age groups. In case ***time constrains*** is a reason for not frequent use of RRI methodologies in the classrooms – as in other countries-, it ***should be taken into account for the development of guidelines for using the resources in the classroom*** - maybe the principle "less is more" in the development of the resources, would allow time for students to engage in argumentative discourse and inquiry.

4. 11.5. Context (informal settings, society) and RRI – Cyprus

In this section, we seek to gain an understanding on the degree to which there are connections between schools and informal setting with an aim to support RRI objectives, as well as on the degree on which the broader societal communities – in which students are active members- are aware of and support RRI initiatives. Information provided aims to facilitate dissemination work and the process of engaging informal educational providers in the project in the country.

Actors that promote RRI initiatives	Examples on how RRI initiatives are promoted
The Environmental Study Center in Pafos (private center)	Conservation and make the connection of RRI and the environment.
Environmental Education Center in Limassol (owned by the church of Cyprus)	Sustainable development and understanding how scientists work (nature of science)
Ministry of Education Environmental Centers (1 in Nicosia and 1 in Troodos)	Sustainable development and understanding the nature of science and changes in the country's changes across the years.

Actors that implement RRI initiatives	Implementation as part of …			
	…the national strategy	…school mission	…teaching strategy	Other (please explain)
Environmental centers	Ministry of Education Environmental Centers & Environmental Education Center in Limassol	Ministry of Education Environmental Centers & Environmental Education Center in Limassol	The Environmental Study Center in Pafos is running private in and pre-service teacher training	Personal initiatives of the private environmental center

There are both private and public Environmental Centers in Cyprus, but there are no science centers or science museums. The first Environmental center in Cyprus was private and is running courses both for schools and teachers, but these courses are not directly linked to the curriculum. The Ministry of Education Environmental centers, and the Environmental Education Center in Limassol run programs that have direct links to the national curriculum, and the teachers are asked to prepare the students before the visit. The topics are loosely linked to RRI, mostly on understanding how scientists work in the nature and in the lab.

Connections between schools and informal education providers			
	Not Evident	***Evident but not prioritized***	***Evident and prioritized***

 **Primary schools**

 **General secondary schools**

 **Vocational Schools**

4. 11.6. Probable barriers and opportunities to the project- Cyprus

In the light of the analysis of the science curriculum in Cyprus that was presented in the previous sections, the following issues that emerge might have implications in various levels within the ENGAGE project:

Probable Barriers:

- Content-base objectives are rather more prioritized in the country in comparison to objectives that are more RRI oriented (for example the acquisition of values); this might be ***a hindering factor need to be taken into consideration in the process of engaging sciences teachers in implementing in the classrooms resources that relate to RRI objectives.***

- ***Content relating to RRI teaching is mainly not evident in the science curriculum.*** This might be a ***hindering factor*** for engaging big numbers of science teachers to implement ENGAGE RRI materials in the classrooms, especially if there is not much autonomy for teachers in the country to implement extra curriculum activities

- Teachers do not seem to be familiar with the notion of argumentation. ***Specific guidelines on implementing argumentation would particularly benefit the accomplishment of the aims of the project in the country***.

- RRI teaching methodologies are not frequently being implemented in the classrooms for all age groups. In case ***time constrains*** is a reason for not frequent use of RRI methodologies in the classrooms – as in other countries-, it ***should be taken into account for the development of guidelines for using the resources in the classroom.***

Probable Opportunities:

- Due to the way science is taught in the country for ***age group 11-15, resources dealing with multidisciplinary issues*** might be more relevant to the educational context; ***for age group 15-16 materials with content addressing a specific discipline*** should be preferred to resources in multidisciplinary format. The above should be taken into consideration in the process of localization and dissemination.

- In the light of reforms in science curriculum tat are currently at the level of reforming science textbook and gradually at classroom implementation, there ***is an***

opportunity for ENGAGE to have an actual impact in the country, by facilitating the transformation of policy envisions to classroom implementation.

- ***In the process of localization and dissemination*** of the project recourses, materials ***associated with nature of science should preferred*** as they seem to be more relevant and associated with the science curriculum content in the country.

- There is ***a fruitful educational context*** in the country for the aims of the ENGAGE project ***in terms the degree to which inquiry based learning is prioritized in the last curriculum reform and in terms of familiarization of pre-service teachers in the methodology.***

References

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5. Conclusions and Recommendations

In an attempt to develop a thorough understanding of current policy intentions and actual practice in terms of RRI curriculum, ***the previous chapter provided a mapping*** of the policies and strategies in place in the area of science education for students 11-16 years old within 11 national contexts across Europe. A first level analysis was conducted for each country under the guidance of the analytical framework and was structured in terms of the main dimensions of analytical framework. This ***analysis resulted in a set of probable opportunities and barriers to the project in each participant country***, aiming to provide elaboration on how easy or difficult will be in each country to implement ENGAGE RRI curriculum and pedagogy.

Following the process of analyzing separately the educational context in each country in relation to RRI, the information provided in the national case studies were ***synthesised by identifying differences and commonalities among the participant countries***. In respect to ***each theme/dimension of curriculum analysis, a set of conclusions*** referring to the whole consortium was reached and is reported in the following lines, leading to a set of ***recommendations for the various work packages within the project*** for more successful accomplishment of the ENGAGE objectives.

5.1. Emerging issues pertaining to countries' science education background.

As it might have been expected there is a wide variation among the 11 countries both in terms of the general educational system and on how science is taught at different students' age levels. From the cross-national analysis of the countries science education background the following issues emerge that are believed to have implications at various levels of the project:

- A number of countries have ***a relatively high centralized educational system (for example Greece, Romania, France);*** this may not allow much autonomy for teachers to implement additional to textbooks materials in the classroom. Additionally, there are countries in which ***the educational system is de-centralized and diverse (for example Germany, Switzerland).*** The organization of Education in the countries should be taken into consideration in the preparation of the teachers' engagement and dissemination plan for the countries especially in the ADOPT phase ***(WP4).***

- ***Given the way science is taught*** at different age levels (multidisciplinary or interdisciplinary versus disciplinary) the following conclusions should be taken into consideration ***in the process of localization and dissemination*** of the project's curriculum materials and resources in the countries of the consortium***(WP3):***

  → Materials in ***multidisciplinary or interdisciplinary format*** might be more relevant to the following cases: Greece (age 11-12), France (age 11-12), Israel (age 11-15), Spain (age 12-14), Norway (age 11-16), Switzerland (age 11-12), Lithuania (age 11-12), and Cyprus (11-14).

  → Materials with content ***addressing a specific discipline*** (physics, biology, chemistry) might be more relevant to the following cases: Greece (age 13-16),

Germany (age 13-15), France (age 13-16), Romania (age 11-16), Israel (age 15-16)), Switzerland (age 11-12), Lithuania (age 13-16) and Cyprus (age 15-16).

Given that the multidisciplinary framework is most suitable for involvement in ENGAGE, ***primary and lower middle school science teachers*** should be the dominant target population (WP4,5,6)

5.2. Emerging issues pertaining to recent curriculum changes in relation to RRI

Several countries are currently or recently been engaged in educational reforms, especially focused on science education. In some of the countries such ***changes seem to be in line with RRI thematic and framework (for example France for age group 11-13, Romania, Israel for age group 13-16, Spain, Switzerland, Lithuania)*** while in others there seem to be a policy renewed focused on fundamental academic knowledge (for example UK, Greece). In general, curriculum changes could not only be seen as a challenge but also as an opportunity for the project:

- On the one hand, it is an opportunity for ENGAGE to have an actual ***impact*** in the various countries, by ***facilitating the transformation of policy envisions to classroom implementation.*** This dimension should be particularly taken into consideration by the Evaluation Work Package ***(WP8).***

- On the other hand, ***curriculum changes have always provided the potential to "sell' professional development*** as providing appropriate up-skilling towards implementation ***(Implementation WPs 4,5,6, and Dissemination WP7).***

5.3. Emerging issues pertaining to curriculum objectives and expected outcomes

In many countries content based objectives (for example the acquisition of content knowledge) are more prioritized in comparison to objectives that are more RRI oriented (like the acquisition of values)- for example in the UK, in Germany, in Greece, in France, in Romania. In addition, RRI aspects are inadequately assessed in formal assessment in many counties. These have implications at various levels of the project:

- The fact that RRI objectives are not particularly evident in the majority of the countries may be ***a hindering factor in the process of engaging science teachers in implementing the ENGAGE recourses***, especially those teaching age groups that are more close to external exams. The importance of addressing RRI aims in science teaching should be made explicit both during the workshops and the online courses (WPs 3,4,5).

- The fact that RRI aspects are ***not fully assessed in formal assessment the country might be a barrier*** for the accomplishment of the project's objectives; ***specific guidelines to the teachers on how RRI objectives can be assessed*** – along with guidelines on implementation of RRI strategies – would benefit the broader uptake of the project' s recourses and materials (WP1).

5.4. Emerging issues pertaining to curriculum content and RRI

The following lines summarize information relating to probable ***opportunities for the project in terms of content*** that is more relevant to each country's curriculum, assessment and teacher training. The following conclusions should be taken into consideration ***in the process of localization and dissemination*** of the project's curriculum materials and resources in the countries of the consortium ***(WP3):***

Country	Curriculum opportunities in terms of content
UK	For age group 12-16: resources relating to genomics, genetic engineering, stem sells, reproductive technologies, biodiversity, new materials (e.g. graphene), life cycle assessment, and nanotechnology For age group 11-14: resources relating to the nature of science
Greece	For age group 11-15: resources relating to socio-scientific issues and technology
Germany	For all age groups, issues relating to technology socio-scientific issues, values and nature of science may be evident but not prioritized both in the curriculum and in teacher training
France	For age group 11-12: resources relating to technology For age group 13-15: resources relating to values
Romania	For age group 11-12: resources relating to socio-scientific issues, values and nature of science. For age group 13-16: resources relating to socio-scientific issues, technology and nature of science.
Israel	For age group 11-12: resources relating to socio-scientific issues and technology For age group 12-16: resources relating to technology.
Spain	For age group 14-16: resources relating to values and nature of science
Norway	For age groups 11-16: all content
Switzerland	Content resources targeting age group 11-14 are more likely to be implemented in the classrooms that those targeting 15-16
Lithuania	For age group 11-16:, resources relating to the socio-scientific issues and values
Cyprus	For all age groups: content relating to nature of science

5.5. Emerging issues pertaining to pedagogical processes and RRI

A mixed picture is evident across the 11 countries in relation to the policies and the implementation of inquiry based learning: in some countries it is part of the curriculum and teachers seem to be well familiarized with the pedagogy (for example in UK, in Lithuania, in Romania, in Norway), while in other countries the reverse is the case (for example in Greece, in Switzerland). It is notable that despite of the above, in most countries inquiry based methodologies are not frequently implemented in the countries of both cases. In addition in the vast majority of the countries argumentation is neither evident in the curriculum, nor

teachers are familiarized with the pedagogy and implement it. The following implications might arise for the project from the above:

- In the case where ***time constrains*** is a reason for not frequent use of RRI methodologies in the classrooms, it ***should be taken into account for the development of guidelines for using the resources in the classroom*** - maybe the principle "less is more" in the development of the resources, would allow time for students to engage in argumentative discourse and inquiry **(WP3 recourses).**
- Specific ***guidelines on RRI methodologies targeting both 'novice' and 'expert' teachers*** would particularly benefit the accomplishment of the aims of the project **(WP1).**
- The fact that RRI pedagogies are not frequently been implemented in the classroom is an important aspect that is worth taken into consideration by the evaluation (WP8). It might be interested ***to investigate the dimension of how the ENGAGE materials and teachers' guidelines will contribute – and up to whet degree- to the transformation of policy envisions to actual classroom practices (WP8 Evaluation).***

5.6. Emerging issues pertaining to context (informal settings, society) and RRI

Information provided by the partners in the previous chapter (Results) in each country indicates that in all countries there are important actors that implement and promote RRI initiatives in the countries. Given that the information mainly concerns dissemination purposes, it has been summarized in D7.1 of the ENGAGE project.

5.7. Recommendations to the project

Based on the conclusions reached by the cross-countries analysis, the following lines summarize a set of ***recommendations per work package within the project*** for more successful accomplishment of the ENGAGE objectives.

WP1- Framework:

Recommendation 1: Specific ***guidelines on RRI methodologies targeting both 'novice' and 'expert' teachers*** would particularly benefit the accomplishment of the aims of the project.

Recommendation 2: ***Specific guidelines to the teachers on how RRI objectives can be assessed*** – along with guidelines on implementation of RRI strategies – would benefit the broader uptake of the project' s recourses and materials.

WP3- Recourses:

Recommendation 3: ***In the process of localization and dissemination*** of the project's curriculum materials and resources in the countries of the consortium, ***the way science is taught*** at different age levels (multidisciplinary or interdisciplinary versus disciplinary) should be taken into consideration.

Recommendation 4: Probable ***opportunities for the project in terms of content*** that is more relevant to each country's curriculum, assessment and teacher training, should be taken into consideration ***in the process of localization and dissemination*** of the project's curriculum materials and resources in the countries of the consortium.

Recommendation 5: ***Time constrains should be taken into account for the development of guidelines for pedagogical strategies*** - maybe the principle "less is more" in the development of the resources, would allow time for students to engage in argumentative discourse and inquiry.

WPs 3,4,5- Implementation

Recommendation 6: The organization of education in the countries (centralized systems versus systems that allow more autonomy to teachers) should be taken into consideration in the preparation of the teachers' engagement and dissemination plan for the countries especially in the ADOPT phase

Recommendation 7: Given that the multidisciplinary framework is most suitable for involvement in ENGAGE, ***primary and lower middle school science teachers*** should be the dominant target population.

Recommendation 8: The importance of addressing RRI aims in science teaching should be made explicit both during the workshops and the online courses.

WP8- Evaluation

Recommendation 8: Given current curriculum changes in many countries, it is an opportunity for ENGAGE to have an actual ***impact*** in the various countries, by ***facilitating the transformation of policy envisions to classroom implementation.*** This dimension should be particularly taken into consideration by the Evaluation Work Package.

Recommendation 9: The fact that RRI pedagogies are not frequently been implemented in the classroom is an important aspect that is worth been taken into consideration by the evaluation. It might be interesting ***to investigate the dimension of how the ENGAGE materials and teachers' guidelines will contribute – and up to whet degree- to the transformation of policy envisions to actual classroom practices.***

Apart of informing the various levels of the ENGAGE project, the hope is that the work on the current situation in the countries' curricula may provide ***useful background information that can deepen understandings on the interrelations between intensions and current***

practices and on ***how to move RRI from words to deeds in a meaningful and constructive manner***, in educational contexts.