

Introduction to Curriculum Materials

This document provides an introduction to the Curriculum Materials including the:

- Background context for the materials
- Definition of creativity in early year science adopted by the CEYS Project
- Processes of curriculum development
- Format of the Curriculum Materials
- Suggestions about how the Curriculum Materials might be used to foster creative inquiry-based approaches to early years science
- Further information available on the CEYS website.

Background

The Curriculum Materials were produced as part of the *Creativity In Early Years Science Project* (CEYS). CEYS was an Erasmus+ funded partnership (involving five partners in Greece, Belgium, England and Romania) that aimed to develop a teacher development course and accompanying classroom materials, to be used in professional development to promote the use of creative inquiry based approaches to early years science. The CEYS project built on the work of the EU FP7 funded project *Creative Little Scientists* (2011-2014) and reflected the high focus on science, mathematics and creativity in education in recent European education policy and the increased focus on creative learning and innovative teaching at all levels of education and training. It was also informed by growing research evidence of young children’s capabilities in science and mathematics, arguments about the importance of science and mathematics in early childhood education and debate about the nature of creativity and inquiry in science and mathematics education.

Definition of creativity in early years science

The CEYS project drew on definitions of creativity and inquiry drawn from reviews of literature in creativity education and science education conducted in the *Creative Little Scientists* project (CREATIVE LITTLE SCIENTISTS, 2012). Key features of inquiry-based approaches and dispositions associated with creativity identified are shown in table 1 below.

Learning activities (linked to key features if inquiry)	Creative dispositions
<ul style="list-style-type: none"> • Questioning • Designing and planning investigations • Gathering evidence • Making connections • Explaining evidence • Communicating explanations (for example Minner et al, 2010)	<ul style="list-style-type: none"> • Sense of initiative • Motivation • Ability to come up with something new • Making connections • Imagination • Curiosity • Ability to work together • Thinking skills (for example Chappell et al., 2008)

Table 1: Features of inquiry and creative dispositions

The CLS definition of creativity in early science and mathematics adopted by the CEYS project is: *Generating ideas and strategies as an individual or community, reasoning critically between these and producing plausible explanations and strategies consistent with the*

available evidence. This needs to be understood alongside the ‘Little c creativity’ definition (Craft, 2001), as shown in the figure below. This signals a focus on creativity as something of which we are all capable (Banaji and Burn, 2010) and recognition of key roles of creativity in both generating and evaluating ideas and strategies in mathematics and science. The importance of generation and evaluation of ideas *within a community* is also emphasised. This includes examination of ideas in the context of existing, widely accepted explanations and strategies.

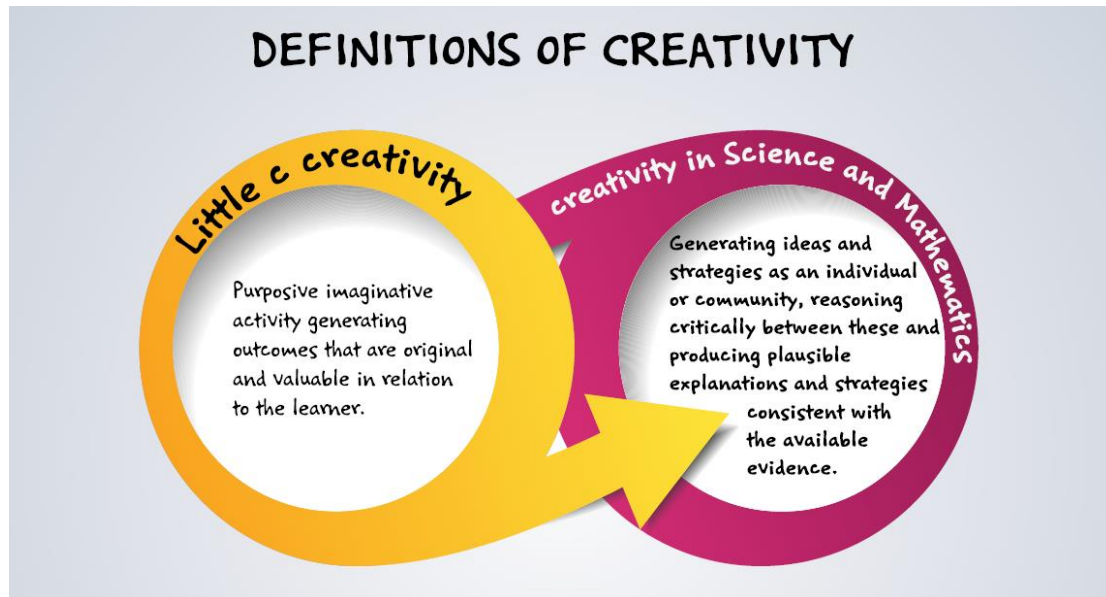


Figure 1: Definition of creativity in early years science

Synergies between Inquiry-based and creative approaches to learning and teaching

The review of literature also suggested a number of synergies between Inquiry Based Science Education and Creative Approaches as outlined below. These provided a framework for examination of opportunities for creativity and inquiry both policy and practice.

- *Play and exploration*, recognising that playful experimentation / exploration is inherent in all young children's activity.
- *Motivation and affect*, highlighting the role of aesthetic engagement in promoting children's affective and emotional responses to science and mathematics activities.
- *Dialogue and collaboration*, accepting that dialogic engagement is inherent in everyday creativity in the classroom, enabling children to externalise, share and develop thinking.
- *Problem solving and agency*, recognising that through scaffolding the learning environment children can be provided with shared, meaningful, physical experiences and opportunities to develop their own questions as well as ideas about scientifically relevant concepts.
- *Questioning and curiosity*, recognising that creative teachers often employ open ended questions, and promote speculation by modelling their own curiosity.
- *Reflection and reasoning*, emphasising importance of metacognitive processes, reflective awareness and deliberate control of cognitive activities, still developing in young children but incorporated into early years science and mathematics practice.
- *Teacher scaffolding and involvement*, teachers mediating the learning to meet

children's needs, rather than feeling pressurised to meet a given curriculum.

- *Assessment for learning*, identifying and building on the skills, attitudes, knowledge and understandings children bring to school; supporting and encouraging children's active engagement in learning and fostering their awareness of their own thinking and progress.

Curriculum development process

Teachers from the 'lead' schools in each country, worked in collaboration to design, develop and evaluate classroom projects focusing on the promotion of creative, inquiry based approaches to science teaching in early years education. The teachers took part in professional development workshops over a year, held in the four participating countries, to support action research in their own classrooms using a common methodology introduced by the project. The Curriculum Materials record and illustrate the learning journeys of the 'lead' teachers and the children in their classes, during action research, in developing creative, inquiry-based approaches to learning and teaching in early years science. The Curriculum Materials have been trialled and evaluated in a wide range of contexts across the participating countries and are intended for use both in the Training Modules produced by the CEYS project and by individual teachers to illustrate both the opportunities and challenges associated with implementing creative inquiry based approaches in the classroom.

Curriculum design components

In designing and reflecting on their classroom projects teachers drew on the definitions of inquiry and creativity shown above. They also built on the framework of Curriculum Design Components associated with 'the vulnerable spider web' (van den Akker 2007 p39) shown in Figure 2 with the rationale at the heart. These different dimensions that frame the curriculum are vulnerable because they are interconnected and what happens in one dimension affects another.

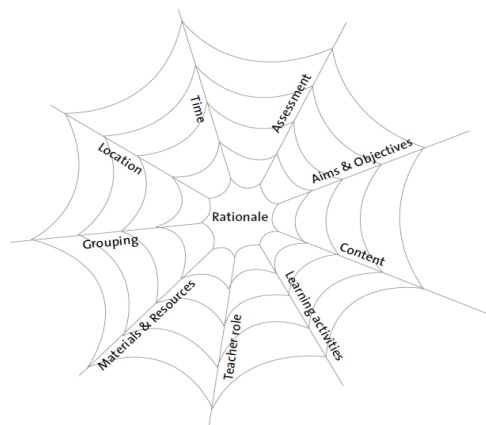


Figure 2: The Vulnerable Spider Web

Format of the Curriculum Materials

Lead teachers produced Curriculum Materials to record their *learning journeys* and those of the children in the form of powerpoint presentations, accompanied by a word document providing *background details* of the school and class context. 10 examples (2 from each partner in the project) are included in this document and have been translated into all partner languages. Three further examples from each partner are available on the CEYS website in English. (Word versions of all the Curriculum Materials in English are also available on the CEYS website.)

While the learning journeys provide rich examples of activities and approaches that might be used or adapted in the classroom, they aim more importantly to capture teaching and learning *processes*. They offer insights into teachers' decision-making and reflections and evidence of children's learning, that illustrate the scope for extending opportunities for inquiry and creativity in varied local and national contexts.

The Curriculum Materials vary in presentation but they share a number of common elements for example:

Initial information (provided in the first page(s))

- Title of the Learning Journey
- Details of the ages of children in the class – note the examples cover a wide age range in both preschool and primary settings.
- A list of the particular **learning activities** (features of inquiry), **creative dispositions** and **synergies** (teaching approaches common to inquiry based and creative approaches) the teacher was seeking to promote (linked to the definitions of creativity outlined above).
- **Background** – key features of the background to the example, such as aspects of the school setting, age group, school policy for science, curriculum links (as appropriate).

Setting the Scene – brief outline of the focus and rationale for the project and implications for planning and teaching for example:

- **Focus:** The aspects of children's creativity and inquiry the teacher focused on – the differences the teacher was seeking to make and aspects of their own practice they aimed to develop (linked to the synergies).
- **Rationale:** The teacher's rationale for the focus – based on their assessments of children's inquiry skills and creative dispositions and/or evaluation of their own practice.
- **Implications for planning and teaching:** The implications for teaching approaches with links as appropriate to the curriculum design components associated with the 'vulnerable spider web'.

Overview of the learning journey – an outline of the sequence of activities involved in the project and the time frame. The time frames vary considerably – some projects took place over a few days, others over several weeks. This is indicated in the background details provided.

Developing the Learning Journey – explanation and reflections on the learning journey over time, illustrated by examples of learning and teaching including:

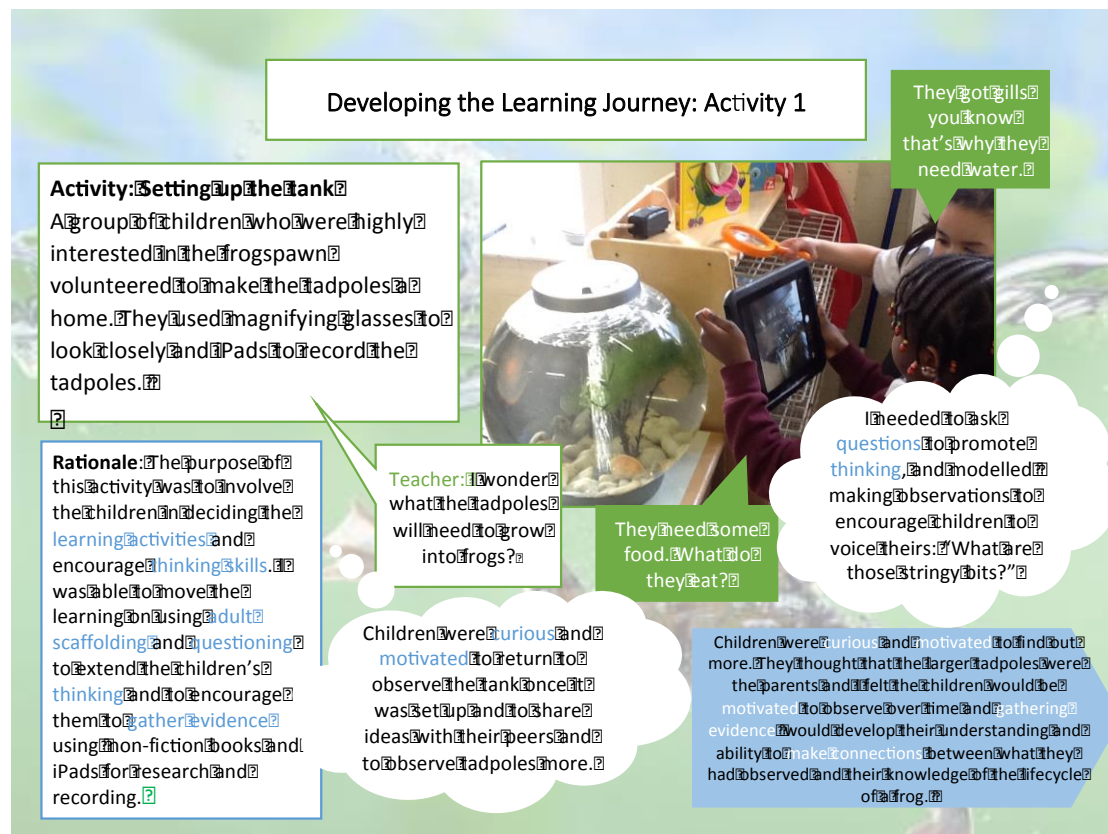
- **Starting points** – an indication of how the project began: this might include for example: a motivating stimulus, experience or event or observation or elicitation of children's questions/interests

- **Sequence of activities** – how the project developed over time.

For each stage in the learning journey teachers were encouraged to draw on records and discussion of their action research processes to:

- *Explain the decisions they made.* How did each activity build on evidence of children’s responses?
- *Explain each activity.* Provide images to illustrate key features such as: nature of activity and resources, teacher interventions and questions, children’s recording, comments, actions, inspiring moments.
- *Highlight examples of children’s inquiry skills and creativity* and ways in which they fostered children’s inquiry and creativity (linked to definition of creativity in science, the synergies and other creativity enabling factors linked to the spider).
- *Indicate how this led to the next activity* – brief reflections to indicate connections

An example is shown below that illustrates some of the common elements included.



Developing the Learning Journey: Activity 1

Activity: Setting up the tank
A group of children who were highly interested in the frogspawn volunteered to make the tadpoles home. They used magnifying glasses to look closely and iPads to record the tadpoles.

Rationale: The purpose of this activity was to involve the children in deciding the learning activities and encourage thinking skills. It was able to move the learning on using adult scaffolding and questioning to extend the children’s thinking and to encourage them to gather evidence using non-fiction books and iPads for research and recording.

Teacher: I wonder what the tadpoles will need to grow into frogs?

They need some food. What do they eat?

They got gills you know that’s why they need water.

I needed to ask questions to promote thinking, and modelled making observations to encourage children to voice theirs: “What are those stringy bits?”

Children were curious and motivated to return to observe the tank once it was set up and to share ideas with their peers and to observe tadpoles more.

Children were curious and motivated to find out more. They thought that the larger tadpoles were the parents and felt the children would be motivated to observe over time and gathering evidence would develop their understanding and ability to make connections between what they had observed and their knowledge of the lifecycle of a frog.

- The activity and rationale are indicated
- The photograph gives a flavour of the nature of the activity.
- The comment boxes provide examples of teacher/child commentary or questions.
- The thought bubbles include teacher reflections on learning/ their own teaching
- The arrow at the bottom suggests implications/next steps

Reflections on the project including

- **Reflections on children’s progress** – based on analysis of children’s progress in relation to inquiry and creativity and linked to the initial aims of the project. In some instances this includes any unanticipated outcomes and children’s own reflections on their learning

- **Teachers’ reflections on their own roles** – analysis in relation to the aims of the project with links to the synergies between inquiry-based and creative approaches
- **Reflections on the classroom environment** - other aspects of the design components associated with the ‘vulnerable spider web’ that contributed to the development of children’s inquiry skills and creative dispositions
- **Next steps for learning and teaching** - based on evidence of learning.
- **Reflection questions for the reader** – designed to encourage readers to consider applications to their own practice.

Ways in which the Curriculum Materials might be used

Potential of the Curriculum Materials

The processes of trialling the Curriculum Materials have indicated their potential for supporting professional development in early years science in a variety of contexts – with individual or small groups of teachers, in school staff meetings and in initial and continuing teacher education.

In general terms the Curriculum Materials illustrate a variety of approaches to opening up the curriculum to enhance opportunities for creative, inquiry-based approaches to learning and teaching, with ideas for activities and experiences that can be adapted for use in different contexts. However they also include specific evidence of teaching and learning processes over time that provide the basis for more detailed discussion of a range of issues such as:

- Opening up activities to extend opportunities for children’s creativity
- Building on children’s idea and interests
- Variety of types of inquiry
- Different modes of representation
- Making connections between experiences and ideas – in and outside the classroom
- Varied modes of assessment – children’s voices

Use of a staged and guided approach

We have found that a **staged and guided approach** is helpful in making the most of what the Curriculum Materials have to offer:

1. Gaining an overview of the learning journey – possible approaches include:

- Time to read through the materials first. They could be provided in advance of training sessions.
- Presentation by a facilitator – showing selected slides to provide the context.

2. Focused analysis, discussion and reflection related for example to:

- Issues and questions identified by the participants
- Focus of the teacher’s learning journey – linked to the synergies
- Evidence of children’s progress – related to inquiry skills, creative dispositions, science concepts
- Reflection questions for the reader

Selecting Curriculum Materials for use within teacher education

The Curriculum Materials can also be used to enhance existing teacher education programmes focused on early years science as well as the Training Modules produced as part of the Creativity in Early Years Science Project. The table attached as an appendix to this

introduction lists the 20 Training Modules developed by the CEYS project (linked to the synergies identified between inquiry based and creative approaches) with suggestions of particular Curriculum Materials that might be used for each module. This may be helpful in selecting appropriate Curriculum Materials for particular contexts and purposes.

Sources of further information about the project

You will find details about the background to the project, recent news and future activities and events on the CEYS website <http://www.ceys-project.eu>.

If you wish to know in more detail about the development of the Curriculum Materials and the wider work of the CEYS project you will also find on the site reports of each stage of the project. Brief details are provided below. All reports are published in English. In addition the following are published in Dutch, Greek and Romanian:

- Examples of the Curriculum Materials and the Curriculum Development Guide
- An outline of the content of each of the Training Modules and the Training Guide

If you are interested in the research carried in the Creative Little Scientists Project (FP7 EU project 2011 – 2014) that informed the CEYS project you can find further details on the project website www.creative-little-scientists.eu. The executive summary of the final report for policy makers and stakeholders can found at http://www.creative-little-scientists.eu/sites/default/files/Recommendations_to_Policy_Makers_and_Stakeholders.pdf.

References

- BANAJI, S. and BURN, A. 2010 2nd edition The Rhetorics of Creativity: A Review of the Literature, London, Arts Council England.
- CHAPPELL, K., CRAFT, A., BURNARD, P., CREMIN, T. 2008. Question-posing and Question-responding: the heart of 'Possibility Thinking' in the Early Years. *Early Years*, 28(3), 267-286.
- CREATIVE LITTLE SCIENTISTS (2012) Conceptual Framework. Deliverable D2.2. EU Project (FP7 Contract: SIS-CP-2011-289081 – Project Coordinator: Ellinogermaniki Agogi, Greece). Leading Authors: A. Craft, T. Cremin, J. Clack, A. Compton, J. Johnston. Available at: <http://www.creative-little-scientists.eu/content/deliverables>
- MINNER, D. D., LEVY, A. J. and CENTURY, J. 2010. Inquiry-based science instruction: what is it and does it matter? Results from a research synthesis years 1984 to 2002. *Journal of Research in Science Teaching*, 47(4), 474-496.
- van den AKKER, J. 2010. Curriculum design research. In T. Plomp & N. Nieveen (Eds), *An Introduction to Educational Design Research*. Enschede: Axis Media-ontwerpers.

Appendix: Suggested use of Curriculum Materials in Training Modules

Module	Title Curriculum Materials	Age group	Country	Languages			
				English	Dutch	Greek	Romanian
1 Using Questions							
	Life cycle of a frog	4-5	England	✓	✓	✓	✓
	Living things and their habitats	7-8	England	✓			
	An icy adventure	3-4	England	✓		✓	
	Water resistance	5-6	Belgium	✓	✓	✓	✓
	On the go	4-7	England	✓	✓	✓	✓
	Changing Seasons	3-4	England	✓			
	Make bread right now	5-6	Romania	✓	✓	✓	✓
2. Resources and learning environment							
	Bath bombs	3-5	England	✓	✓	✓	✓
	Skeletons	7-8	England	✓	✓	✓	✓
	Crime scene investigation	7-8	England	✓			
	Electricity	4-5	England	✓			
	An icy adventure	3-4	England	✓		✓	
	Science from stories: Investigating materials	4-5	England	✓			
	Make bread right now	5-6	Romania	✓	✓	✓	✓
	Exploring materials: Can water be transferred?	4-5	Romania	✓			✓
3.Focus on the nature of science							
	Skeletons	7-8	England	✓	✓	✓	✓
	Plants	4-6	Greece	✓	✓	✓	✓
4. Focus on IBSE							
	Everyday materials	5-6	England	✓			
	An icy adventure	3-4	England	✓			
	Water resistance	5-6	Belgium	✓	✓	✓	✓
	Oxygen	4-5	Belgium	✓	✓		
	Germination and growth	5-6	Romania	✓	✓	✓	✓
	Plant and Butterfly Cycles	5-6	Greece	✓		✓	
5.Focus on practical investigation which fosters creativity							
	Air resistance	5-6	England	✓			
	Emma and her food preferences	4-5	Romania	✓			✓
	Investigating Snails	3-4	England	✓			
	The Rainbow	3-6	Romania	✓			✓
	Make bread right now	5-6	Romania	✓	✓	✓	✓
	Floating boats	5-6	Greece	✓	✓	✓	✓
	Plant and Butterfly Cycles	5-6	Greece	✓		✓	
	The sounds around us	6-7	Greece	✓		✓	
6. Collaboration and group work							
	Crime Scene investigation	7-8	England	✓			
	Everyday materials	5-6	England	✓			
	A wisp of air	7-8	Belgium	✓	✓	✓	✓
	The liquid tower	6-7	Belgium	✓	✓		
	Properties of materials: problem solving and reasoning	4-5	England	✓			
	Bath bombs	3-5	England	✓	✓	✓	✓
	Investigating Materials	5-6	England	✓			
	Bees and their communities	4-5	Greece	✓		✓	
7. Role play and exploration							
	Electricity	4-5	England	✓			
	An icy adventure	3-4	England	✓		✓	
	Super soup	4-6	Belgium	✓	✓		
	Water resistance	5-6	Belgium	✓	✓	✓	✓
	The sounds around us	6-7	Greece	✓		✓	

Module	Title Curriculum Materials	Age group	Country	Languages			
				English	Dutch	Greek	Romanian
8. Varied modes of expression and representation							
	Life cycle of the frog	4-5	England	✓	✓	✓	✓
	Electricity	4-5	England	✓			
	A wisp of air	7-8	Belgium	✓	✓	✓	✓
	Super soup	4-6	Belgium	✓	✓		
	Oxygen	4-5	Belgium	✓	✓		
	Floating boats	5-6	Greece	✓	✓	✓	✓
	Plants	4-6	Greece	✓	✓	✓	✓
	Plant and Butterfly Cycles	5-6	Greece	✓		✓	
	Bees and their communities	4-5	Greece	✓		✓	
	The sounds around us	6-7	Greece	✓		✓	
	The rainbow	3-6	Romania	✓			✓
9. Role of the teacher							
	Properties of materials: problem solving and reasoning	4-5	England	✓			
	Everyday materials	5-6	England	✓			
	Science from Stories: Investigating materials	4-5	England	✓			
	An icy adventure	3-4	England	✓			
	Floating boats	5-6	Greece	✓	✓	✓	✓
	Plant and Butterfly Cycles	5-6	Greece	✓		✓	
10. Cross curricular project work							
	Crime Scene Investigation	7-8	England	✓			
	Air resistance	5-6	England	✓			
	Science from stories: Investigating materials through stories	4-5	England	✓			
	Emma and her food preferences	4-5	Romania	✓			✓
	Bees and their communities	4-5	Greece	✓		✓	
	The sounds around us	6-7	Greece	✓		✓	
11. Linking learning in and outside school							
	Crime Scene investigation	7-8	England	✓			
	Living things and their habitats	6-7	England	✓			
	Any icy adventure	3-4	England	✓		✓	
	Air resistance	5-6	England	✓			
	Science from stories: investigating materials	4-5	England	✓			
	Bath bombs	3-5	England	✓			
	Plants	4-6	Greece	✓	✓	✓	✓
	Plant and Butterfly Cycles	5-6	Greece	✓		✓	
	Bees and their communities	4-5	Greece	✓		✓	
12. Reflection and reasoning							
	Crime Scene investigation	7-8	England	✓			
	Electricity	4-5	England	✓			
	Air resistance	5-6	England	✓			
	An icy adventure	3-4	England	✓		✓	
	Castles and moats	4-5	England	✓			
	Investigating Snails	3-4	England	✓			
	Floating boats	5-6	Greece	✓	✓	✓	✓
	The sounds around us	6-7	Greece	✓		✓	
13. ICT to enhance inquiry							
	Crime Scene investigation	7-8	England	✓			
	Life cycle of a frog	4-5	England	✓	✓	✓	✓
	Study of simple physical phenomena	4-6	Greece	✓		✓	
	Bees and their communities	4-5	Greece	✓		✓	
	Investigating Materials	5-6	England	✓			
	The sounds around us	6-7	Greece	✓		✓	

Module	Title Curriculum Materials	Age group	Country	Languages			
				English	Dutch	Greek	Romanian
14. Planning for progression							
	Life cycle of a frog	4-5	England	✓	✓	✓	✓
	Electricity	4-5	England	✓			
	Living things and their habitats	6-7	England	✓			
	Skeletons	7-8	England	✓	✓	✓	✓
	Air resistance	5-6	England	✓			
	Science from Stories: investigating materials	4-5	England	✓			
	Bath bombs	3-5	England	✓			
15. Interpreting policy							
	Crime scene investigation	7-8	England	✓			
	Everyday materials	5-6	England	✓			
	Skeletons	7-8	England	✓	✓	✓	✓
	Electricity	4-5	England	✓			
	On the go	4-7	England	✓	✓	✓	✓
16. Assessment for learning							
	Life cycle of a frog	4-5	England	✓	✓	✓	✓
	An icy adventure	3-4	England	✓		✓	
	Electricity	4-5	England	✓			
	Skeletons	7-8	England	✓	✓	✓	✓
	Living things and their habitats	6-7	England	✓			
	Bath bombs	3-5	England	✓	✓	✓	✓
	On the go	4-7	England	✓	✓	✓	✓
	Floating boats	5-6	Greece	✓	✓	✓	✓
	The sounds around us	6-7	Greece	✓		✓	
17. Involving children in assessment							
	Super soup	4-6	Belgium	✓	✓		
	Oxygen	4-5	Belgium	✓	✓		
	Living things and their habitats	7-8	England	✓			
18. Nature of inquiry							
	Skeletons	7-8	England	✓	✓	✓	✓
	Crime scene investigation	7-8	England	✓			
	Life cycle of a frog	4-5	England	✓	✓	✓	✓
	Plants	4-6	Greece	✓	✓	✓	✓
	The sounds around us	6-7	Greece	✓		✓	
19. Nature of creativity							
	Materials	5-6	England	✓			
	Snails	3-4	England	✓			
20. Structured and unstructured play and exploration							
	Properties of materials: problem solving and reasoning	4-5	England	✓			
	Electricity	4-5	England	✓			
	Air resistance	5-6	England	✓			
	An icy adventure	3-4	England	✓		✓	
	Exploring Materials: Can water be transferred?	4-5	Romania	✓			✓
	Plants	4-6	Greece	✓	✓	✓	✓
	Floating boats	5-6	Greece	✓	✓	✓	✓
	The sounds around us	6-7	Greece	✓		✓	
	The rainbow	3-6	Romania	✓			✓



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