CEYS E-twinning Tool Kit

A guide for designing a school twinning project on creativity development through early years science education

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1. Introduction. The CEYS project

The CEYS project (Creativity in Early Years Science Education) responded to the needs identified at European level concerning science education, i.e. that it should be more creative, based on children's curiosity and inquiry. The project's main objective was accomplished by creating a teacher development course and accompanying materials to be used in European professional development to promote the use of creative approaches in teaching science in preschool and early primary education (children 3 to 8 years old), in the frame of inquiry-based educational environments.

The predecessor of the CEYS project was the Creative Little Scientists (CLS) research project [1], whose main outcomes were used to define training requirements for teachers in terms of the knowledge and competences required to use creative and inquiry-based approaches in early years science education. Based on the Curriculum Design Principles [2] developed in the CLS Project, accompanied by a set of teacher outcomes in the form of Exemplary Teachers Training Materials [3] the CEYS partnership developed a training course that aims at improving the training of teachers and teacher educators in Initial Teacher Education and/or Continuous Professional Development, as regards fostering the synergies between inquiry-based learning and creative approaches in their classrooms.

Using the foundation prepared by these two projects (CLS and CEYS), the present tool kit is an output of the CEYS project aiming to offer teachers information and guidance on how to implement a European collaborative project on fostering creativity in early years science education. It is available in all the languages of the countries represented in the consortium (English, Dutch, Greek and Romanian).

Considering the fact that teachers are the key agents in promoting and nurturing creativity and inquiry in classrooms, teachers' participation in collaborative projects on fostering creativity can play a key role in spreading this initiative to their peers. This tool kit is a model for teachers to facilitate their collaboration and empower them with the ability to formulate a project proposal, help them understand the issues to be addressed in all the stages of the project proposal preparation, and advise them how to work together for its implementation.

This guide explains how to proceed, by presenting all the necessary stages to go through in order to create a successful project proposal. The process of developing a proposal consists in providing responses to the following issues: identifying a common subject for the partners involved and establishing a title, setting up a partnership to carry out the project, formulating a short description of the proposed project and the project target group, presenting the project objectives, describing the project procedures and activities to be implemented, presenting the tools to be used to reach the proposed goals, description of the expected results/ outcomes. Additionally, the guide contains some Annexes, aiming to assist the project team in designing the proposal. Some of these aids are general (e.g. the Gantt chart), others being specific to the topics under discussion (e.g. creativity and inquiry in science education).

This tool kit offers some resources for the designing of the project proposal: a template for structuring the proposal, suggested forms for children's assessment and the evaluation of activities.

The two previously mentioned EU funded projects (CLS and CEYS) constitute both the theoretical background [4] and a valuable repository of resources, training materials produced by the consortium partners [5] and the Curriculum Materials developed by the teachers participating in the CEYS project [6].

The project proposal frame suggested in this guide can be used as the backbone for more elaborated proposals. Teachers' project proposals prepared by using the instructions in the present tool kit can be submitted to various national and international bodies/programmes. This tool kit, being an output of an Erasmus+ funded project, can also be used for schools collaboration projects on the e-Twinning platform https://www.etwinning.net/, the largest community for schools in Europe.

2. Creativity in early years education

Very well documented background information on the nature of creativity in general, innovation in education with an emphases on creativity development, and on the role played by creative dispositions in respect to teaching creatively and teaching for children's creativity can be found in the CLS report "Final Report on Creativity and Science and Mathematics Education for Young Children" [7]. In this reference document various aspects of creativity in education (psychodynamic, cognitive, psychometric, pragmatic, confluence approaches) are analyzed and their interactions are highlighted. Social connotations of creativity as well as its relation with innovation are discussed. The reader can find valuable benchmarks related to the role of creativity in early years educational settings and on the research carried out in this field. Teachers may also find useful references to the conceptualization of creativity in relation to school curriculum, as well as answers to questions like: What do you mean by creativity in early years science?; How might children's creativity be recognized? What are the characteristics of creative, inquiry-based approaches to teaching? The document offers examples of creativity in teaching and learning that illustrate these characteristics and recommendations for the development of policy and practice.

As regards the teaching practice in early years science, the Final Report on Creativity and Science and Mathematics Education for Young Children recognizes the need "to

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encourage attributes such as risk taking, independent judgement, commitment, resilience, intrinsic motivation and curiosity. Additionally, curiosity, connection making, autonomy and originality have been documented as key features of the pedagogy and ethos found in the classrooms of highly creative professionals (Grainger, Barnes and Scoffham, 2006). Creative approaches are arguably open and applicable to a range of contexts and subject domains."

The theoretical background is supported by European and international examples reflecting particular interpretation of creativity in the educational process. An applied discourse underlines different aspects of practical pedagogy from creativity development perspective, targeting children's training for questioning and teachers' efforts to encourage and reinforce their curiosity, participation and support for creative thinking. Issues related to creativity evaluation in early years are also debated.

An extensive references list, almost 200 publications, are referred in the document, helping interested readers, researchers, teachers, policy makers, curriculum developers, to focus on topics of interest for their work.3. Designing an e-twinning project proposal

3. Designing an e-twinning project proposal

eTwinning is the largest social network community in Europe aiming to collaboration between teachers and between children. Collaboration can also be established between some other people involved in education: head teachers, parents, school librarians, coordinators, etc.

The eTwinning platform https://www.etwinning.net/en/pub/index.htm is the place where teachers can find a partner for a collaborative eTwinning project and opportunities for their own professional development.

The information below will guide teachers in designing their own project proposal about fostering creativity by teaching science through inquiry-based approaches, based on the research carried out by the Creative Little Scientists and Creativity – CLS and Creativity in Early Years Science Education - CEYS projects.

3.1 Project title

Finding a name for your project can be a quite difficult task. It should be short, easy to remember and original; something as eye-catching. The title you choose should also be concise, but clear and suggestive to characterize the scope of the project. For an easy reference to the project you will find helpful to provide an acronym to your project. This acronym has to be easy to pronounce and you have to avoid any confusion with some words in foreign languages. Besides that, the title of your project has to be easily translated into your partners' languages.

Speaking about the identity of your project, you have to think in advance to a logo, a graphical representation of your project, an image which can be further developed into a "brand". The design of this logo has to consider very attentively the audience you are targeting through this project (teachers, teachers' trainers, children, policy makers, etc.). This logo has to embed the primary message for your project.

3.2 Brief description of the project

The subject you already selected should describe one or several learning activities, inquiry-based and linked to creativity, as it is widely recognized that inquiry in science education has a major role in fostering creativity, innovation and curiosity. The link between science education through inquiry approaches/pedagogy and creativity is a key foundation of the CEYS project [4].

This section of the proposal should be written after finalizing the whole proposal and the essence of each project section should be presented here. A short description of the proposed project should be provided, highlighting the following items: partners description; project objectives; pedagogical aspects addressed; target group(s); duration; expected outcomes; dissemination strategies.

3.3 Target groups

The target group can cover a diversity of people, according to the objectives of the project. For example, the project target group could be children of 3 - 8 years old, teachers and educators for these age groups, school stakeholders – parents, school inspectors, schools principals, policy makers or curriculum developers.

At this stage of the proposal you have to be aware about the role played by your target group(s) as this issue impinges on other constituents of the proposal, such as: pedagogical aspects to be considered; procedures to follow; tools to be used; materials and resources needed; costs; location; personnel involvement.

3.4 The aims of the project

In defining the project aims/ objectives you have to identify your major personal or group problems you expect to be solved by the implementation of the project. Please explain briefly the reason(s) for your choice or provide arguments to support your option(s). You may find frameworks used in the CLS project helpful in identifying particular issues you wish to address. For example you could use the van den Akker spider web model (Annex 4.1) and CLS associated List of Factors (Annex 4.2) to identify each partners' strengths and weakness, as well as threats and opportunities. A discussion on the SWOT (strengths, weakness, opportunities and threats) analysis can be found in paragraph 5.1.

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Note 1

The objectives you are setting can be linked to specific situations:

- You are interested to improve your practice in inquiry-based science education (IBSE).
- You plan to develop some teaching aids materials to support science teaching through inquiry.
- You are targeting best practice transfer for your partners.
- You want to develop/ adopt some learning units to enhance creativity development to your children.
- You focus your efforts on pedagogy adapted to a new curriculum you have to face.
- You are interested to learn from other educational environments.
- You are preparing your degree (masters, PhD) and so you need assistance from peers.

Note 2

The objectives, linked to children creativity development and use of IBSE, can be:

- improve your IBSE teaching skills;
- raise your colleagues' awareness on creativity teaching;
- develop your children's questioning skills;
- support a creative thinking environment;
- achieve problem-solving skills;
- develop children's inquiry skills/ process skills;
- exercise group working in the classroom;
- gain expertise on formative assessment;
- design of new techniques, tools and teaching methods, as appropriate;
- manage science class time and resources;
- test your different role as teacher in science classes;
- enhance you capabilities to teach science in non-formal settings;
- enrich your expertise in outdoor science education;
- gain expertise on ICT use in science teaching and learning;

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- develop your abilities to work with a colleague.

3.5 The procedure to follow during project implementation. Pedagogical issues addressed

The aim of the project proposal is to foster creativity by teaching science through inquiry-based approaches. The content of the project should be built on partners' needs identified in the section 3.4 of the proposal. Sharing ideas with your partner/partners for deciding on the project content is an important stage in the proposal. The subject content can be inspired by a learning activity you already know or one you know from your colleagues. You can use a story, a scenario, an idea you just read in the journals or searched on the Internet. Annex 4.4 (Model of learning activity sheet) helps in structuring the learning activity to build the project on.

The pedagogical issues to be taken into account can be exemplified by the spider web dimensions (Annex 4.1) and the CLS associated List of Factors (Annex 4.2).

As presented in the CLS deliverable Creativity in Science and Mathematics Education for Young Children: Executive Summary, "the rationale in the middle of the spider web refers to the central mission of the curriculum. It is the major orientation point for curriculum design, and the nine other components are ideally linked to the rationale and preferably consistent with each other. The spider web illustrates the many interactions and interdependence of the parts but also the vulnerability. If you pull or pay too much attention to one of the components, the spider web breaks (van den Akker, 2007, p41)."[8]

In Annex 4.2, for each spider web dimension, the factors in the table can be considered also for improving the pedagogical skills of the teachers as they characterize the creative practices in early years science education. The list of factors reflects the concepts and processes identified in the CLS project's conceptual framework as characterising creative practices in early years science and mathematics education. It is recommended that teachers take also into consideration the pedagogical synergies between inquiry-based and creative approaches to early years science education, identified in the frame of the CLS project (Annex 4.3) [4].

In deciding on the content of the proposal as well as on the pedagogical issues, teachers can also be inspired by the CLS Exemplary Teacher Training Materials [3], or by the outputs of the CEYS project in the form of the Training Materials and Curriculum Materials [6].

So, bear all this information in mind; all these examples from teachers practice will help you to find the way to build the project proposal.

Note 1

a. Break down your project into manageable subsets, easy to handle as it concerns space, time and human resources.

b. Distinguish between priority tasks and secondary ones.

c. You have to describe in detail the way each activity will be carried out, according to your expertise, environment and resources.

d. You have to prepare at this point a timetable for the project implementation, e.g. as a graphical representation where you have specified the duration of each major activity and to mark the start/ end point.

e. You have to consider the particular school context you will run the project (curriculum applied, administration support, resources, cultural background, children population composition, etc.).

f. If different activities are correlated (e.g. one provides the input to subsequent activities, or some activities can (have to be) run in parallel) you have to underline these aspects.

g. For each outcome you have to include some sort of implementation assessment criteria (e.g. number of classroom activities, number of children involved/ monitored). Establish milestone points where project progress has to be evaluated.

h. Include some reflection space in the project, both for your team and children involved.

i. For different activities you will adopt to fulfil your goals and for each of the planned objectives you have to evaluate the risks and provide alternative solutions. Identify facilitating circumstances and would-be difficulties in running the project.

j. To achieve the planned objective do you have to run the activities once or iteration and corrections are needed?

k. Ask colleagues and peers for an evaluation of your project plan.

l. Keep detailed, updated and standardized documentation of the activities, solutions, deficiencies, results, costs.

m. Consider the possible changes of the project environment (curriculum modification, defection of some partners, costs, other priorities, etc.).

n. Consider participation of other entities (parents organizations, educational and science expects, non-formal learning environments).

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Note 2

It would be helpful to separate the overall project run in different subtasks/ activities, easily to handle and monitor. The "Model of learning activity sheet" (Annex 4.4) might help you in the planning and implementation of the project.

Note 3

In programming the implementation of the project the use of a Gantt chart (Annex 4.5) is indicated, as it assists you in monitoring the time span of different activities and the way resources are required to be available and are employed in time.

Note 4

Good project management implies some milestones when specific actions have to finish and some decisions have to be considered. At this point in time, you need to have evaluated both your students and your own work. The forms provided in Annexes 4.6 and 4.7 will help you to organize such activities.

3.6 The tools to be used

You have to specify the tools to achieve each objective, as for example:

- literature review;
- development/ testing in the classroom of learning units;
- development/ testing in the classroom of teaching aids;
- development/ testing in the classroom of new assessment methods;
- translation of teaching materials;
- development of a virtual space to share teaching experience;
- surveys;
- practice guides;
- achieving the goal through digital literacy.

Additional suggested means for project implementation:

- exchange of best practice;
- curriculum development;
- teachers' training;
- national/ European educational policies to follow;
- development of learning units;

- exchange of short visits, teaching practice;
- preparation of future project proposals;
- development of a network;
- support children exchange;
- development of teaching aids;
- preparation of common studies.

3.7 The expected outcomes

You have to define clear, measurable outcomes of the project:

- studies on a specific topic;
- classroom trials run on specific subjects;
- learning units and teaching materials;
- organization of events (workshops, demo sessions, science fairs, meeting with peers etc.);
- writing of a project proposal.

In the mean time, you have to propose a dissemination strategy for the project results. You can consider:

- project web page;
- leaflets;
- newsletters;
- conference papers;
- dissemination/ demo sessions;
- teachers' meeting;
- exchanges of good practice;
- visits exchange;
- disscussion fora;
- distribution of reports and guides.

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4. Annexes

Annex 4.1 Spider web model

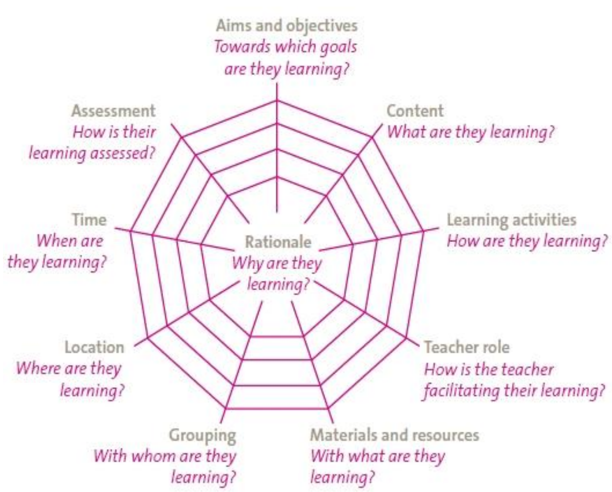
Partner teachers may find it helpful to use the curriculum design components associated with the 'vulnerable spider web' model of van den Akker (2007), the figure below. In his model, van den Akker identifies the following components: rationale, aims and objectives, content, learning activities, teacher role, materials and resources, grouping, location, time and assessment. These different dimensions that frame the curriculum are 'vulnerable' because they are interconnected and what happens in one dimension affects another.

The spider web model was employed in both CLS and CEYS projects and proved to be very useful in making teachers aware of their own practice.

By examining the spider web dimensions and the CLS associated List of Factors (Annex 4.2) [9], partners need to make an analysis of their teaching practice and determine which of these dimensions would be of interest for them to work on and which improvements can be formulated as a motivation for the project proposal.

The partners can choose as many they want of key aspects presented in the spider web, but they have to consider analysing and solving them during the timeframe they established for the project. For a convenient duration we suggest to focus on two or maximum three of the spider web dimensions.

The correlation between the spider web dimensions and the list of factors may help partner teachers to reflect and decide on the problems they expect to solve by the implementation of the proposal.



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Annex 4.2 List of factors

The curriculum dimensions and associated List of Factors are offered as support and provide a common framework for reflection on teachers own practice related to opportunities for creativity in early science.

	Dimensions Sub questions	Factors important to nurturing creativity in early years science and mathematics
Aims/purpose/priorities	**Rationale or Vision** *Why are they learning?*	• Science economic imperative • Creativity economic imperative • Scientific literacy and numeracy for society and individual • Technological imperative • Science education as context for development of general skills and dispositions for learning
	Aims and Objectives *Toward which goals are the children learning?*	• Knowledge/understanding of science content • Understanding about scientific inquiry • Science process skills; IBSE specifically planned • Capabilities to carry out scientific inquiry or problem-based activities; use of IBSE • Social factors of science learning; collaboration between children valued • Affective factors of science learning; efforts to enhance children's attitudes in science and mathematics • Creative dispositions; creativity specifically planned
Teaching, learning and assessment	**Learning Activities** *How are children learning?*	*Focus on cognitive dimension incl. nature of science* • Questioning • Designing or planning investigations • Gathering evidence (observing) • Gathering evidence (using equipment) • Making connections *Focus on social dimension* • Explaining evidence • Communicating explanations
	Pedagogy *How is teacher facilitating learning?*	• Play and exploration: e.g. role of play valued • Motivation and affect: e.g. efforts made to enhance children's attitudes in science and mathematics • Dialogue and collaboration: e.g. collaboration between children valued • Problem solving and agency: e.g. use of IBE/PBL; children's agency encouraged • Questioning and curiosity: e.g. children's questions encouraged • Reflection and reasoning: e.g. children's metacognition encouraged; diverse forms of expression valued • Teacher scaffolding and involvement: e.g. sensitivity to when to guide/stand back • Assessment for Learning: e.g. sensitive and responsive approach

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	Assessment *How is the teacher assessing how far children's learning has progressed, and how does this information inform planning and develop practice?*	*Assessment function/purpose* • Formative • Summative • Recipient of assessment results *Assessment way/process* • Strategy • Forms of evidence ; excellent assessment of process +product, Diverse forms of assessment valued • Locus of assessment judgment – involvement of children in peer/self assessment
Contextual Factors	**Materials and Resources** *With what are children learning?*	• Rich physical environment for exploration; Use of physical resources thoughtful; Valuing potential of physical materials • Environment fosters creativity in science • Sufficient space • Outdoor resources; Recognition of out of school learning • Informal learning resources • ICT and digital technologies; confident use of ICT • Variety of resources • Sufficient human resources • No reliance on commercial schemes
	Location *Where are children learning?*	• Outdoors/indoors; recognition of out of school learning • Formal/nonformal/informal learning settings • Small group settings
	Grouping *With whom are children learning?*	• Multigrade teaching • Ability grouping • Small group settings • Number of children in class
	Time *When are children learning?*	• Sufficient time for learning science
	Content *What are children learning?*	• Science as separate areas of knowledge or in broader grouping • Level of detail of curriculum content • Links with other subject areas / cross-curriculum approach; evidence of science integration (planned or incidental) • Subject-specific requirements vs. broad core curriculum • Content across key areas of knowledge

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Annex 4.3 Pedagogical synergies between creativity development and inquiry-based science teaching

Inquiry Based Science Education (IBSE) teaching and learning and approaches which foster Creativity (Creative Approaches, CA), according to the Conceptual Framework of the Creative Little Scientists project [4], appear to have synergies and differences.

The pedagogical synergies between inquiry-based and creative approaches to early years science education, identified in the frame of the CLS project as being common to both demarches are [4,8]:

Play and exploration, recognizing that playful experimentation/exploration is inherent in all young children's activity, such exploration is at the core of IBSE and CA in the Early Years.

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, plays a crucial role in learning in science and mathematics **and** is a critical feature of IBSE and CA, enabling children to externalize, share and develop their thinking.

Problem solving and agency, recognizing that through scaffolding the learning environment children can be provided with shared, meaningful, physical experiences **and** opportunities to develop their creativity as well as their own questions and ideas about scientifically relevant concepts.

Questioning and curiosity, which is central to IBSE and CA, recognizing across the three **domains** of science, mathematics and creativity that creative teachers often employ open ended questions, and promote speculation by modeling their own curiosity.

Reflection and reasoning, emphasizing the importance of metacognitive processes, reflective awareness and deliberate control of cognitive activities, which may be still **developing** in young children but which are incorporated into Early Years practice, scientific and mathematical learning and IBSE.

Teacher scaffolding and involvement, which emphasizes the importance of teachers mediating the learning to meet the children's needs, rather than feel pressured to meet a given curriculum.

Assessment for learning, emphasizing the importance of formative assessment in 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.

Teachers are encouraged to promote as many synergies they consider need particular attention in their teaching which should be reflected in the project proposals.

Annex 4.4 Model of learning activity sheet

Activity title: focus topic/subject

Who is involved? Motivation for students and teachers

Location and target group

Required resources

Duration and activities schedule

Expected results

Evaluation of results

Reflections: What has to be changed? What was learned?

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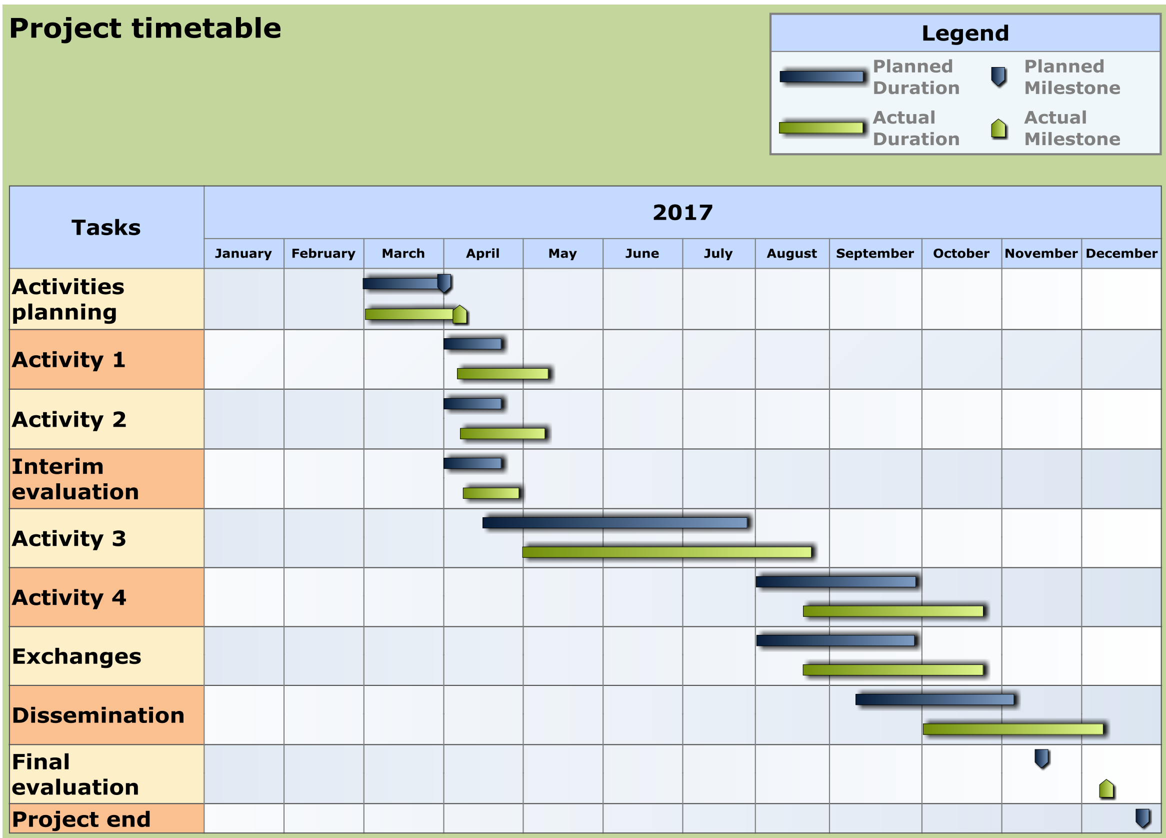
Annex 4.5 Example of Gantt chart

This chart is a useful tool for planning the activities for the whole duration of the project and for their monitoring. It is a graphical representation of what partners have to do, their tasks and the milestones to be achieved. The figure below is an example of the Gantt chart.



Annex 4.6 Children assessment form

It is recommended to use the form below developed by the CEYS project considering the reference of Centre for Literacy in Primary Education - CLPE: the Primary Language Record (2005) and in the light of the CLS research.

Dates and areas of science		
Context and background information about the activity: • Kind of science (investigations, fair test, problem solving…) • How the activity arose • Whether the child was working alone or in collaboration with others • Shorts or sustained activity • Link with other curriculum areas		
Child's approach to the activity (including)**:** *affective factors of science* learning, such as: • attitudes to science • attitudes to science learning • attitudes to learning *social factors of science learning*, such as: • collaborative and communal engagement • communication		
Strategies the child used to carry out inquiry / problem-based activities, such as: • questioning • gathering evidence • interpreting evidence • communicating findings **Science process skills**, such as: • predicting • observing • measuring • describing • classifying		
Knowledge and understanding the child shows: such as • science content (ideas/concepts and processes) • scientific inquiry (how scientists develop knowledge and		

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understanding of the surrounding world)		
Creative dispositions, such as: • sense of initiative • motivation • innovative thinking • connections making • imagination • curiosity creative thinking skills • problem solving skills • reasoning skills		
Child's own response to the activity: • pleasure and interest • relating to previous experience • reflecting on own learning		

Alternatively, teachers can use the second form to evaluate children evolution in developing skills related to inquiry-based learning. This form represents an adaptation of the Fibonacci project document "Tools for Enhancing Inquiry in Science Education" [10]:

Items	**Evaluation (Circle your choice)**	
Did children work on questions which they identified as their own, even though introduced by you?	yes	no
Did children make predictions based on their ideas?	yes	no
Did children take part in planning an investigation?	yes	no
Did children carry out an investigation themselves?	yes	no
Did children gather data using methods and sources appropriate to the inquiry question?	yes	no
Did children consider their results in relation to the inquiry question?	yes	no
Did children propose explanations for their results?	yes	no
Did children collaborate with others during group work?	yes	no
Did children report their work in some form to the whole class?	yes	no

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Annex 4.7 Activity evaluation sheet

For the activities planned and run in the context of your project it is recommended to use the evaluation form below in order to assess the implications and results of these activities.

Items	Evaluation
How did the results compare with the planned outcomes?	
The location, organization, timetable, resources - were they adequate to the purpose of the activity?	
What would I like to change?	
What messages do I have for our community?	
What might be the implications for curriculum, practice, teacher training?	
Are there any changes needed to children assessment processes?	

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5. Additional help for project proposal preparation

5.1 SWOT analysis

Firstly we recommend identifying, in the teaching practice, partners' strengths and weakness, as well as threats and opportunities by using the SWOT analysis (the technique for understanding the Strengths and Weaknesses, and for identifying both the Opportunities open to you and the Threats you may confront. You can find below some suggestions for using SWOT framework in the context of science teaching by fostering creativity in an inquiry-based environment, but you can also identify other issues to work on.

a) Strengths which you want to share with colleagues and friends, for example:
   - You have just returned from an inquiry-based science teaching course.
   - Your school has a successful cooperation with an entity abroad on outdoor activities.
   - You think that your country's educational system has equipped you with ICT skills.

b) Weaknesses, for example:
   - You are worried about available resources.
   - You have to catch up with latest curriculum developments.
   - You feel that you are not confident in class management when working in groups.
   - You are wondering about the role you have to play in non-formal science teaching.

c) Opportunities, for example:
   - You noticed that a European call for projects on science teaching for your children's age group is under way.
   - A call for investment proposal related to science school teaching was launched.
   - A training course for teachers on science education was announced.

d) Threats, for example:
   - A new curriculum for science teaching at early age was promoted by your national / local authorities.
   - New promotion criteria were set for primary school teachers.
   - You are interested to change the school you are active in.

- New assessment standards for children science progress were issued.
- Inquiry and creativity became buzzwords of the day, and you are interested to be on board.

5.2 Expected costs

In designing a more complex, project you have to answer the following questions:

- What costs are you expecting for your project implementation?
- What are the categories of costs;
- What is the way to share these costs?
- What financial resources are available?
- What is the timetable for project expenditures?
- How do you plan to handle financial resources?
- Is there any sponsorship available?

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