Module 5: Practical investigation which fosters creativity

Aims of the module

- Explore the role of practical investigations in fostering creativity in early years science;
- Highlight the nature of creativity and a range of creative dispositions;
- Prompt participation in investigations and reflecting upon them;
- Widen awareness of structured and unstructured explorations;
- Provide space to plan investigations that foster children's creativity.

Links to the Content Design Principles and Outcomes

2. Teacher education should provide teachers with skills and competences to carry out practical investigations of science and mathematics in the classroom.

> 2.1 Teachers should be able to instigate and involve children in the design and conduct of practical investigations of science and mathematics in the classroom, as such activities can contribute to the development of children's creativity.

17. Teacher education should address with teachers issues in ensuring rich provision, planning and use of resources (including digital resources) in and out of the classroom to support children's inquiry and creativity.

> 17.1 Teachers should be able to organise and use materials (including everyday materials), resources (including ICT and natural resources) and equipment (including digital equipment and simple laboratory instruments) in the classroom, school and wider environment, both indoors and out, to support independent inquiry and creativity.

Rationale for the module

Creative approaches to learning highlight the role of play and curiosity as drivers for problem finding and problem solving (Cremin et al., 2009). In the creativity research literature it is evident that problem finding and problem solving are core elements and that engagement with problems can foster child agency, ownership of learning and the development of self-determination and control (Craft et al., 2012; Cremin et al., 2006; Cremin et al,2009; McConnon, 2017; Raggl, 2006; Sugrue, 2006;). These studies collectively suggest that children's creative engagement in finding their own problems, problems which they wish to explore or solve is central to creativity, and links closely to their curiosity and questioning stance. Additionally, teachers' trust, interest and respect for children's questions facilitates young people's sense of autonomy and the degree to which they are in control of their own learning. Rather than leading, the teachers in these various creativity studies often set open ended tasks which the children undertook in groups or pairs and which they organised themselves, following their own ideas and interests as collaboratively engaged problems solvers.

The role of investigation and its potential to lead to innovation, originality, ownership and control has been noted (Jeffrey and Woods, 2003):

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- It is widely recognized and evidenced that young children show curiosity and seek to explore the world through their interaction with materials of diverse kinds from a very young age (Craft, 2002; McConnon, 2017).
- Published studies confirm children learn better when they behave with intentionality, are self- determined and use imagination; they innovate and take risks and in practical investigations often become immersed in the process (Cremin, Burnard and Craft, 2006).
- Early Years creativity and science education share in common recognition of children's exploratory and investigative engagement, and their consideration of ideas and conceptions (Davies, 2016).
- The research literatures pertinent to IBSE and CA reveal that to different degrees both approaches profile particular pedagogical practices that seek to foster children's learning. The common pedagogical synergies identified with regard to the Early Years include: play and exploration, motivation and affect, dialogue and collaboration, problem solving and agency, questioning and curiosity, reflection and reasoning, and teacher scaffolding and involvement (Cremin et al., 2015)

What are the issues for teachers?

- Teachers' conceptions of creativity can represent a challenge, if they see creativity as a special gift of the few, not an ability of all humans/each child.
- Research suggests practitioners see creativity as concerned with supplying specific resources or activities, rather than processes.
- The literature notes that the majority of teachers see creativity in science being fostered in teachers by means of curriculum development that encompasses four stages: uncertainty, visioning, realization, and readiness. 'Letting go' of scheduled instructions and adopting risk-taking, play, collaboration, questioning and curiosity might be a way to promote creativity in early years science education (Bore, 2006).
- Planning practical investigations requires teachers to balance offering 'open' opportunities to investigate and giving instructions or structuring the task. This is challenging.

Overview of the module

The module consists of the following activities:

1. **Introduction:** An introduction to the central role of practical investigations and the potential of such to foster creativity in early years science followed by a LEGO-based engagement task and an overview of creativity
2. **Problem finding and problem-solving tasks** for groups
3. **Analysis of classroom examples** to examine how practical investigations can foster creativity;
4. **Reflection** on how the teaching approaches adopted in the CLS examples influence the children's creativity;
5. **Consideration of the consequences** of the workshop for participants' own planning;
6. **Reflection** on what has been gained from the workshop – both content and process, in relation to the aims.

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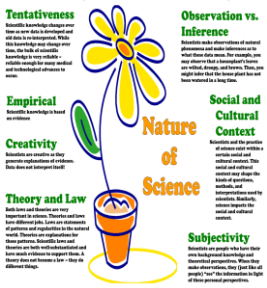
Module at a glance

Time	Task	Materials	Grouping
00.00	1. **Introduction** • Introduction to facilitator and their role • Presentation of the aims and rationale • Overview	PowerPoint presentation • Aims • Links to Content Design Principles and Outcomes • Session rationale – making links to research and policy developments in the field • Outline of the session	Whole group
00.10	*Engagement task* • Invite participants to 'make something from the resources'/ LEGO bricks, facilitator(s) observe and record creative dispositions evidenced. • Discuss 'what happened', issues and questions emerging from this open-ended task. • Consider the nature of science linking to creativity (+link to this task)	LEGO bricks Flip-chart for listing issues and questions raised Task 1: Handout of Nature of Science (Akerson, 2011)  	Groups of 4 Followed with feedback with whole group
00.40	*Creativity* • Creativity (big and little c) • CLS definition of creativity, creativity in early years science, • Creative dispositions • IBSE and CA: synergies	PowerPoint presentation	Whole group
00.50	2. **Problem finding and problem solving investigation** for groups (1 and 2) • Observers in the groups note evidence of creative dispositions and feed back. • Small groups discuss the influence of the task on the dispositions. • Whole class discussion : to what extent did the investigation's design influence creativity shown, connect to LEGO investigation.	Task 2: Problem finding and problem-solving investigations Task 2: Creative Dispositions Resources: Newspaper, sellotape, string, scissors. Post-it notes	3 groups (of 6 people)
1.30	Break		
1.50	3. **Analysis of classroom examples** • Background and contexts • Invite groups to choose an episode to analyse • Analysis related to - Setting, space and resources - Child agency	PowerPoint slides Handouts of CLS templates: BE Observation corner 'autumn' BE Colouring with natural materials BE The Carpenter corner BE The Pizza	In groups (of 4 people)

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	- Role of teacher - Nature of learning activity - Opportunities for formative assessment - Opportunities for creativity	*For each group* Copies of a classroom example Task 3: Analysis record sheet for examples for practice - handout Flip chart and pens	
2.10	4. **Reflection on how investigations in the templates might foster creativity.** • Refer back to CLS definitions of creativity in early years science and creative dispositions and link to Barrow and space for learner self-direction. • Work in pairs. Annotate the copies of the episodes, at least the one they analysed, with regard to creativity and creative dispositions. • Brief feedback with whole group – opportunities within each template – particular strengths/ aspects that need further encouragement – record comments on flip chart.	PowerPoint slide of Barrow framework Flip chart and pens	Pairs Whole group
2.30	5. **Implications for own planning** • In pairs discuss one practical investigation you've undertaken in your own classroom. • Share these in small groups. Discuss as small group and consider the implications for planning to foster creativity. • Record implications for planning - using the handout provided.	Task 4: Planning an investigation - handout	Pairs Small group
2.45	6. **Create a mini action plan and reflect on session and learning from it** • In pairs identify two things to take forward re investigations planned to foster creativity. • Focus in pairs on a mini action plan, discussing what will you plan, when, how to structure, it, how to assess the children's learning and their creativity. • Consider in what ways did the different activities support your developing thinking?How far have the aims of the session been met? Share in whole group.	PowerPoint slides of aims Evaluation form	Pairs Whole group
3.00	End		

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Teacher education pedagogy

1. **Introduction to the central role of practical investigations and the potential of such to foster creativity in early years science followed by a practical LEGO-based activity and an overview of creativity.** This module draws on the definition of creativity in early years science adopted by the CEYS Project (Creative Little Scientists, 2012) and key features of inquiry-based approaches to science education. The early LEGO engagement task provides an opportunity for participants to step into shoes of learners experiencing how it feels to be faced with tasks and challenges that might not immediately 'reveal' their explicit purposes – something children may experience when exploring science around them. The task is followed by an overview of creativity.
2. **Problem finding and problem solving tasks for groups.** The second pair of investigations, only one of which a group undertake, highlight that problem finding is equally as important a scientific concept as problem solving. Participants are exposed to different 'directional' level of instructions and reference to Barrow helps to underline the importance of different approaches to learner self-direction. The purpose of using the Creative Dispositions as a prompt for observation and discussion is to ensure these terms are used and debated and evidence of them related or otherwise to the specificity of the task.
3. **Analysis of classroom examples to examine how practical investigations can foster creativity.** Even though the classroom episodes have the potential to foster interest and encourage debate, participants may need support in engaging with the evidence shown in the templates. It is helpful if facilitators are familiar with the background to the episodes/templates/curriculum materials selected and provide a brief introduction to each one at the start. Details of templates/episodes could be found on the CLS website www.creative-little-scientists.eu and curriculum materials on the CEYS website http://www.ceys-project.eu . The analysis record sheet with the 6 main fields helps focus discussion and provides a basis for sharing analyses with others.
4. **Reflection on how the teaching approaches adopted in the classroom examples influence the children's creativity**. Asking participants to reflect on opportunities for creativity is important in making connections with creativity *explicit.* Asking participants to *annotate* their copies of the classroom examples is useful in focusing on the types of activities and opportunities for creativity in the transcripts.
5. **Consideration of the consequences of the workshop for participants' own planning.** The implications for planning activity provide opportunities for participants to fill in the discussions/planning sheet and make direct connections to their own practice.
6. **Reflection on what has been gained from the workshop – both content and process in relation to the aims.** All the recordings completed during the session are designed to provide participants with a starting point for reviewing their discussions and learning across the session and the implications for practice. They encourage consideration of the processes as well as the content of learning to feed into an evaluation of the session.

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Background reading

Defining creativity in early years science

This workshop draws on both the definition of creativity in early years science developed in the Creative Little Scientists project and key features of inquiry-based approaches to science(IBSE) education. You may find it useful to provide opportunities for participants to become familiar with these prior to the workshop. For example both:

- Module 4 Focus on inquiry-based science – link with creativity and
- Module 5 Focus on practical investigation which fosters creativity

explore links between inquiry-based and creative approaches to science education.

The executive summaries of the Final Reports of the Creative little Scientists project

- D6.5 Final Report on Creativity and Science and Mathematics Education for Young Children EXECUTIVE SUMMARY
- D6.6 Recommendations to Policy Makers and Stakeholders on Creativity and Early Years Science EXECUTIVE SUMMARY

also provide an accessible introduction to the definitions of creativity and inquiry used during the session, with illustrations from the classroom. These documents can be found on the CLS website at http://www.creative-little-scientists.eu/content/deliverables.

Cremin, T. et al (2015) Creative Little Scientists: exploring pedagogical synergies between inquiry-based and creative approaches in early years science. *Education 3-13*, *43*(4), 404-419.

This article built on the work of the Creative Little Scientists Project provides a useful introduction to the pedagogical synergies identified by the project between IBSE and CA to science learning and teaching.

Newton, D. P. and Newton L. D. (2009) Some student teachers' conceptions of creativity in school science, *Research in Science & Technological Education*, 27(1), pp 45-60.

This article by Newton and Newton reports findings from their study of teachers' view of creativity in science and highlights common issues and challenges.

The Conceptual Framework (D2.2) for the CLS project, also available on the CLS website at http://www.creative-little-scientists.eu/content/deliverables highlights that practical investigations offer rich opportunities for children to develop their creativity. Such investigations demonstrate the synergistic relationship between IBSE and approaches which foreground creativity. These include:

- *Play and exploration*, recognising 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 experience 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 Creative Approaches (CA), enabling children to externalise, share and develop their thinking.

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- *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*, which is central to ISBE and CA, recognising across the three domains that creative teachers often employ open ended questions, and promote speculation by modelling their own curiosity
- *Reflection and reasoning*, emphasising the importance of metacognitive processes, reflective awareness and deliberate control of cognitive activities, which may be still developing in young children but which is incorporated into Early Years practice, scientific and mathematical learning and IBSE.
- *Teacher scaffolding and involvement*, which emphasises the importance of teachers mediating the learning to meet the child's needs, rather than feel pressured to meet a given curriculum.

The challenge for teachers is to achieve a balance between structure and freedom in Early Years educational settings, adopting a more dialogical pedagogical model in which the teacher orchestrates standing back with collaborative intervention in science classrooms.

Suggested classroom examples for use during the module

The following classroom examples would act as useful starting points for discussion.

From the *Creative Little Scientists* project at http://www.creative-little-scientists.eu/content/deliverables.
Selected Classroom Episodes: BE Observation corner 'autumn', BE Colouring with natural materials, BE The Carpenter corner, BE The Pizza in D4.4 Appendix Selected Episodes of Practice
From the *Creativity in Early Years Science Project at* http://www.ceys-project.eu Curriculum Materials

Title	Age group	Country
Air resistance	5-6	England
Emma and her food preferences	4-5	Romania
Investigating Snails	3-4	England
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

However, it is important to review and select examples appropriate to your context and audience. Other examples can be found on the CLS and CEYS websites.

Module resources

The following documents are provided as separate files in the Module folder for adaptation and use as appropriate during the module:

- Powerpoint presentation
- Task 2 Instructions for problem finding and problem solving investigations 1 – How to make an animal

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- Task 2 Instructions for problem finding and problem solving investigations 2 – How to make an spider whse body does not touch the floor

- Recording sheets for the different activities:
  - Task 3 Analysis recording sheet –Examples from practice
- Handouts
  - Task 1 Handout showing Nature of Science poster
  - Task 2 Handout of Creative dispositions.
  - Task 4 Planning investigations - handout

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