Module 20: Structured and unstructured play and exploration

Aims of the module

- Introduce participants to the nature of exploratory processes as part of play and exploration in early years
- Increase awareness of how exploratory processes can be used to foster inquiry-based and creative approaches to early years science education
- Offer guidance on how to capitalize on 'seizing the opportunity' through exploration of unexpected elements, situations, moments and 'opportunities'
- Explore the role of exploratory processes in supporting the synergies between inquiry and creativity.

Links to the Content Design Principles and Outcomes

7. Teacher education should familiarise teachers with a range of formal and informal inquiry- and creativity-based learning, teaching and assessment approaches and strategies and their use in relation to authentic problems within the areas of science and mathematics.

    7.2 Teachers should be able to use a range of strategies both formal and informal for supporting children's extended engagement with an area of study and progression in learning in science and mathematics.

14. Teacher education should equip teachers with knowledge and skills to use a range of formal, non-formal and informal learning environments, including the outdoor environment, both the school grounds and the wider environment beyond the school, in their teaching of science and mathematics.

    14.2 Teachers should be able to recognise and build on opportunities for informal learning in science and mathematics within the school environment, for example within day to day routines or child-initiated games and other activities in school classrooms or outdoor play areas.

    14.3 Teachers should be able to elicit and build on children's informal learning of science and mathematics outside school, at home or in the wider environment.

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.

    17.4 Teachers should be able to evaluate provision for free flow play in their school settings.

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Rationale for the module

Why are playful exploratory processes in early years science education important?

Children are naturally curious and explore in order to make sense of the world. As they play and explore they compare, ask questions and communicate their discoveries. Thus making space for children to think, ask questions, make predictions, experiment, look for explanations and draw conclusions is important. This 'children's science' emerges naturally as they seek to learn about the world around them (Johnston, 2008) and develop creative explanations of natural phenomena in the process.

The Conceptual Framework for the CLS project, adopted by the CEYS project, available on the CLS website at http://www.creative-little-scientists.eu/content/deliverables), identifies *play and exploration* as one of the synergies between creative and inquiry-based approaches to learning and teaching. Adopting such an exploratory approach to teaching and learning science can mirror some of the ways professional scientists work. This module focuses on creative exploration, provides examples of this in action and seeks to support teachers in planning for such playful scientific inquiry.

Such inquiry often capitalizes upon children's fascination, engagement, awe and wonder which in turn can prompt their aesthetic engagement and ignite their curiosity, leading to the use of scientific inquiry (Milne, 2010), and sustaining their interest in science (Wickman, 2006). However as Perrier and Nsengiyumva argue, the aesthetic is not simply a catalyst, but 'a necessary condition for learning to occur' (2003: 1124). Creativity research also highlights the importance of engaging children affectively and emotionally (Woods, 2001) and this is enhanced when they are engaged in playful exploration. Emphasizing the relevance of science through hands-on experience of an aesthetic nature can help children start to see connections between science and their close surroundings, and as research indicates, this is motivating and is likely to drive further inquiry (Koballa and Glynn, 2007; Kramer and Rabe-Kleberg, 2011).

The nature of creative exploration during play

Exploration is a vital part of the scientific process. Children engaging in exploratory processes develop cognitive, behavioural and affective attitudes (Johnston, 2014). Creative exploration, Milne and Cremin (2016) argue 'is a sequential or cyclic model of exploring for understanding in children's science'. It recognizes that young children naturally seek explanations for experiences that have some effect on their feelings and attitudes and connect to how they think about or view natural phenomena. As they create explanations they often develop a richer understanding, particularly if they have communicated their ideas and justified these. This can lead to an appreciation of the nature of science. Children may engage in many processes and may ask many questions as they explore creatively, see Table 1, although this is not a linear process.

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Creative exploration		
Explore	A problem, situation, phenomenon, artifact, model event, story	Wonder
Observe	What is happening? What changes happened? What materials are involved? What are the main parts? What are the key aspects? What do these parts/structures do?	Wonder about
Identify evidence	What is the cause and effect of changes? What is the function? What parts are interacting with other parts? What are the outcomes of these interactions? What trends and patterns keep occurring?	
Create explanations	Personal explanations supported by evidence are created and processes to test them are planned	
Investigate	Find out, measure, compare, verify, test, clarify, identify	
Evaluation	A self-evaluation of these investigations may lead to new or modified explanations, doubts about existing idea or tentative conclusions. These tentative conclusions need to be communicated to others for peer evaluation and feedback	Wonder at
Further investigation	Evaluated explanations can lead to: re-exploration, seeking further explanation, leading to further investigation	
Making connections	Explanations are used or applied to make sense of or clarify other contexts where similar phenomena are involved	Wonder whether

Table 1 Sequential elements of the creative exploration model for developing personal understanding (Milne and Cremin, 2016: 63)

What are the issues for teachers?

- **The complexity of the exploratory processes**

For some teachers recognising the complexity of the exploratory processes may not be easy. Some teachers may assume that nearly providing a selection of appropriate resources is sufficient and may not recognise multiple elements in young children's exploratory

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processes (see Table 1). The notion that simply providing resources and allowing children to play will lead to children developing their scientific learning has been discredited by Harlen (2000).

- **Seizing opportunities**

For teachers seizing opportunities to capitalise upon children's wonder about some natural phenomena that is happening and can be observed, can be challenging. Fletcher & Stead (2015 p.75) use the term 'spontaneous sciencing' to describe the moment a child sees something of interest to them and responds to it i.e. noticing the ice formed on a puddle outside. This is not always possible to pre-plan and needs the teacher to respond in the moment. There are though ways to plan for these possibilities occurring including for example, exploring the outdoors, visiting a farm and creating an enabling environment.

- **Providing the space and time for extended exploration**

Teachers need to set aside time for the exploration of natural phenomena and seek to avoid hurrying children onto to generating hypotheses or explanations before they have taken the time to engage fully- cognitively and aesthetically. Balancing the time needed with the time available can be difficult. Children need both space and time to engage in extended exploration and to be able to return to this at different times; sometimes on their own, sometimes with their peers and sometimes with a teacher present. Being able to leave the materials for exploration out for children to return to can present logistical issues in some settings.

- **The balance of teacher intervention**

The challenge is achieving the 'right' amount of teacher intervention. Exploration is promoted when the teacher adopt the role as a facilitator rather than an imparter of knowledge (Johnston, 2014). Teachers may feel the need to be present at all times during such exploration, but recent research has shown that open discussion in exploratory contexts without a teacher nurtures children's creativity and scientific understanding (Kramer and Rabe-Kleberg 2011). In this Flemish project entitled 'Haus der Kleinen Forscher' (the House of Little Scientists), the authors suggest that children need space/opportunities in science to explore and work on their own and in peer groups, not just with their teacher. Too much teacher intervention can reduce children's collaborations and their agentic and aesthetic engagement in the problem or phenomenon. Delaying instruction until the children have had a chance to investigate on their own may promote innovation and discovery (Bonawitz et al., 2011).

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- **Subject Knowledge**

It can be a challenge to some teachers to recognize and making explicit the 'science' inherent in the natural phenomena that has interested the child and in the opportunities for further exploration.

Overview of the module

The module consists of the following activities:

1. A **brainstorming** activity preceded by a brief overview of the module including elements of creative exploration
2. **Introduction** to the central role of exploratory processes in play as used in early years science education preceded by an introductory exploratory task/activity
3. **Opportunities for participants to share their own classroom experiences** and discuss challenges of 'seizing the opportunity' in response to an example of playful exploration
4. **Discussion of classroom examples** from Creative Little Scientists and Creativity in Early Years Science projects - What helps children expand their natural exploratory processes?
5. **Discussion of implications** for overcoming of challenges and barriers and what is one thing I would do differently
6. **Reflections** on what has been gained from the workshop – both content and process, in relation to the aims of the workshop.

Module at a glance

Time	Task	Materials	Grouping
00.00	**1. Introduction** • Presentation of facilitator and his/her/their role/s • Presentation of the main aims and objectives of the workshop • Overview of the module including elements of creative exploration	Powerpoint presentation • Aims • Links to Content Design Principles and Outcomes • Session rationale	Whole group
00.15	**Brainstorming** Brief brainstorm in small groups: What is exploration? Where does play come into this? Look at the photographs of the moments, which might spark curiosity and lead to exploration. What five things/processes are they involved in? (i.e. observation, wonder). Each group to jot each process on a post it note and stick on their handout. Collect ideas and share.	Powerpoint slide of four moments of natural phenomena Task 1: A printed copy of photographs of the moments - 1 for each group - handout	Small groups (4-5) – different sizes
00.30	**2. Introductory task – exploratory activity** Participants observe the effect of adding washing up liquid to food colour droplets in milk, which creates swirls of colour.	For each group: • Flat plastic tray • Whole milk (approx 500ml)	Small groups (4-5) – different sizes

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	Participants could consider the aspects of wondering at / about /whether that they have experienced. Participants can list questions for further investigation that they would like to know/find out (e.g. What happens if you use water instead of milk? Will you get the same reaction?) Participants put themselves in the shoes of the children – what might the children want to explore further? **Presentation of different elements of creative exploratory processes as part of play in early years** • Presentation of elements of exploratory play • Presentation of exploratory processes • Issues and concerns connected to 'seizing the opportunity • Participants briefly discuss how they approached the introductory activity and whether they felt they managed to 'explore' playfully (based on the presented elements of and approaches to exploratory processes). • Where are the elements of wondering, wondering about, wondering at and wondering whether in the task?	• Food colour (red, yellow, blue, green) • Washing up liquid • Cotton buds • Pipettes PowerPoint presentation Task 2: Approaches to exploratory process: A3 Recording sheet/table and post it notes for recording elements of/approaches to exploratory processes during the introductory activity	Whole group Small groups for discussion (same as in the previous activity)
1.35	**3. Opportunities for participants to share their own classroom experiences and discuss challenges in response to an example of playful exploration** When do you feel you foster exploratory processes in your classrooms (in general)? When do you feel you foster exploratory processes in your science-based lessons? Challenges and positives Any issues i.e. recognizing which opportunity to seize, interventions or assessment – what are the concerns of teachers with 'seizing the opportunity' and providing the conditions for encouraging exploratory processes in early years science education?	Task 3: A3 Recording sheet/table of the usage of playful exploration and post it notes for recording challenges and positives	Pairs + Whole group
1.50	**Break**		
2.10	4**. Discussion of classroom examples - task for groups** (A, B and C) Analysis of classroom interactions Divide the group of teachers into groups of 4 to 6. Provide 1- 2 templates per group (groups can have the same templates).	Powerpoint slides of task Copies of 2 episodes or templates from CLS for example Selected templates:	Groups of 4-6 people

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	Invite groups to discuss: • How and whether children's exploratory processes were fostered? • Which elements and approaches to exploratory processes can you notice? • What are the opportunities for children's decision making? • What is the agency of the children? • What is the role of the teacher? • Is the group or individual exploratory work assessed and by what means? • How could you build on these explorations? Ask groups to record their responses to each question, including any questions or issues raised. Appoint a scribe to feedback the group response	BE_Colouring GE_Water inquiry *For each group* Copies of 2 examples 2 copies of A3 Recording sheet with 4 boxes to record responses to the questions listed. Flip chart and pens Task 4: Analysis recording sheet -	
2.10	5. **Implication for overcoming of challenges and barriers and what is one thing I would do differently** Use the recording sheet Feedback from the groups	Task 5: Mini action plan - handout and/or 2-4 copies of A3 Recording sheet Flip chart and pens	Small groups (4-5) – different sizes Whole group
2.45	6. **Reflections on what has been gained from the workshop** - In what ways did the different activities and discussions support your developing thinking? - How far have the aims of the session been met?	Powerpoint slides of aims Flip chart Evaluation form	Whole group
3.00	End		

Teacher education pedagogy

1.**A brainstorming activity preceded by a brief overview of the workshop including elements of creative exploration**

Participants are first introduced to the overview of the workshop including elements of creative exploration in order to 'kick start' their brainstorming activity during which they are asked to think about 'what is exploration' and 'where does play come into this'. The whole first part of the workshop is planned to 'make participants think' about creative exploration and its elements i.e. to make them explore creatively the notion of creative exploration. Hence the prompt in the shape of Powerpoint slide of four moments of natural phenomena that should initiate brainstoriming and the process of collecting different answers to the question 'what five processes are they involved in'.

2. Introduction to the central role of exploratory processes in play as used in early years science education preceded by an introductory exploratory task/activity

Participants are asked to explore and wonder about (as well as at and whether) the effect of adding washing up liquid to food colour droplets in milk. The task provides conditions for free creative exploration and wondering about further questions that may arise from the activity as well as wondering about next potential explorations connected to the one they carried out. Putting themselves in the shoes of children, the participants are given an

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opportunity to feel the thrill of creative exploration and think about what would children get inspired to want to investigate next.

After having experienced the exploratory task, the participants are presented with different approaches to and elements of exploratory processes as part of play in early years so that they can get a 'starting point' for forthcoming discussion of their own classroom experience.

Sequential elements of the creative exploration model for developing personal understanding are presented below:

Creative exploration		
Explore	A problem, situation, phenomenon, artifact, model event, story	Wonder
Observe	What is happening? What changes happened? What materials are involved? What are the main parts? What are the key aspects? What do these parts/structures do?	Wonder about
Identify evidence	What is the cause and effect of changes? What is the function? What parts are interacting with other parts? What are the outcomes of these interactions? What trends and patterns keep occurring?	
Create explanations	Personal explanations supported by evidence are created and processes to test them are planned	
Investigate	Find out, measure, compare, verify, test, clarify, identify	
Evaluation	A self-evaluation of these investigation may lead to new or modified explanations, doubts about existing idea or tentative conclusions. These tentative conclusions need to be communicated to others for peer evaluation and feedback	Wonder at
Further investigation	Evaluated explanations can lead to: re-exploration, seeking further explanation, leading to further investigation	
Making connections	Explanations are used or applied to make sense of or clarify other contexts where similar phenomena are involved	Wonder whether

After having heard about the presented elements and approaches to exploratory processes, participants briefly apply them to their experience of the introductory activity thus 'testing' the frameworks.

This 'presetting' phase provides two important steps:

a) help participants prepare them for the forthcoming activity
b) help participants feel confident to later discuss their own classroom experience freely and to use presented approaches to and elements of exploratory processes for the analysis of what they have been doing in their classrooms so far.

3. Opportunities for participants to share their own classroom experiences and discuss challenges of 'seizing the opportunity' in response to an example of playful exploration

This second task provides an important opportunity to explore participants' experiences and expertise. Since the previous part of the workshop equipped participants with elements and approaches to exploratory processes, the discussion should contribute to raising awareness

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of participants' own activities, attitudes and beliefs connected to exploratory processes that have contributed to fostering children's creativity. The discussion would be prompted by a Power point slide of a classroom example of one of the CEYS lead teacher who spontaneously followed one child's interest/action of bringing a snail he fond on the way to the nursery. Undoubtedly the snail example will bring up a discussion about challenges of and obstacles to 'seizing the opportunity'.

4. Discussion of classroom examples to examine

The third task encompasses analysis of other teachers' classroom practices. The classroom examples have considerable potential to foster interest and encourage debate. However participants may need support initially in engaging with the evidence shown in the episodes and templates. It is helpful if the module facilitators are familiar with the background to the episodes/templates selected and provide a brief introduction to each one at the start of the activity. Details can be found in the relevant Country Reports found on the CLS website www.creative-little-scientists.eu under deliverables D4.3 Country Reports. The recording sheet with the seven key questions helps focus discussion and provides a basis for sharing analyses with others.

5. Discussion of implications for overcoming of challenges and barriers and what is one thing I would do differently

This part of the session draws both on participants' previous experience and on the insights gained through tasks. Discussion of implications for overcoming of challenges and barriers to 'seizing the opportunity' for creative exploration and play in early years science education consolidates acquired knowledge and experience of exploratory processes. It also focuses on the implementation of newly discovered connections between experienced activities/presentations and own practice. Mini action plans based on brief reflective exercise on 'what is one thing I would do differently' are produced and shared with the whole group in order to enable implementation of the insights acquired in discussions.

6. Reflections on what has been gained from the workshop – both content and process, in relation to the aims of the workshop.

It can be useful to relate the feedback from this activity to key points made in relation to tasks– to provide an overview of implications for the teacher. This helps provide awareness of the gained insights and their implementation in the classroom.

Background reading

Defining creativity in early years science

This workshop draws on both the definition of creativity in early years science adopted by the CEYS project (Creative Little Scientists, 2012) and key features of play and exploration in creative and inquiry -based approaches to science education. You may find it useful to provide opportunities for participants to become familiar with these prior to the workshop. For example:

- Module 7 Role of play and exploration in inquiry and creativity

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

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- 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.

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 Colouring, GE Water inquiry 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
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

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 1: A printed copy of slide for each group – exploration process
- Task 2 Approaches to exploratory process
- Recording sheets for the different activities:
  - Task 3 Analysis recording sheet – Fostering playful exploration – own examples
  - Task 4 Analysis recording sheet – Examples from practice
- Handouts
  - Task 1: A printed copy of slide for each group – exploration process
  - Task 5: Mini action plan

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