Module 18: Nature of inquiry

Aims of the module:

- Enhance awareness of characteristics of inquiry-based approaches to science education
- Distinguish different purposes of practical work – related to the development of skills, processes, concepts or attitudes in science
- Discuss key features of scientific investigations and the varied opportunities they offer for creativity
- Examine the role of the teacher in fostering children's own decision making in investigations and in making connections between questions, planning, evaluating evidence and reflecting on conclusions.
- Consider ways in which classroom investigations can help foster children's understanding of the nature of science and the varied ways in which scientist work.

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 in the classroom.

> 2.2 Teachers should have a more detailed knowledge about the nature of inquiry and investigations in early years science in order to be able to recognise the opportunities they offer both for creative learning and developing children's creativity.

3. Teacher education should advance teachers' understandings about the nature of science and how scientists work, confronting stereotypical images of science and scientists.

> 3.1 Teachers should be able to advance children's understanding about the nature of science and how scientists work, confronting stereotypical images of science and scientists.

6. Teacher education should provide pedagogical content knowledge to stimulate inquiry and problem solving in science education.

> 6.1 Teachers should have knowledge of all essential features of inquiry and problem solving (questioning, designing or planning investigations, gathering evidence, making connections, explaining evidence, communicating and reflecting on explanations), their different purposes, degrees of structure and guidance (including open, guided and structured inquiries), and varied opportunities they offer for creativity.

> 6.5 Teachers should be able to foster opportunities for children's agency and creativity in learning in inquiry and problem solving – in particular the importance of children making their own decisions during inquiry processes, making their own connections between questions, planning and evaluating evidence, and reflecting on outcomes.

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Rationale for the module

Why is understanding the nature of scientific inquiry important?
In recent years there has been increasing focus internationally on inquiry-based approaches to developing concepts, skills, processes and positive attitudes in science education. In addition aims for science education reflect a growing emphasis on the need for pupils to develop an understanding of the 'nature of science' and 'procedural understanding'. According to Gago et al. (2004, p138):

> The 'nature of science' has become an important concern in the curriculum. This often means the rejection of the stereotypical and false image of science as a simple search for objective and final truths based on unproblematic observations. The recent emphasis on understanding the nature of science is related to the attempt to give more attention to its social, cultural and human aspects. Science is now to be presented as knowledge that is built on evidence as well as upon arguments deployed in a creative search for meaning and explanation.

However as highlighted in the Conceptual Framework adopted by the Creativity in Early Years Science Project (Creative Little Scientists, 2012) both the nature of science and of inquiry-based approaches to science education have also been the subject of considerable debate.

What do inquiry-based approaches involve?
Inquiry Based Education reflects the recommendations of Dewey over 100 years ago who considered that there was too much emphasis on facts without enough emphasis on science for thinking and an attitude of the mind. In Dewey's model, the student is actively involved, and the teacher has a role as facilitator and guide. According to Drayton and Falk (2001, p.25),

> The inquiry-based approach to science education [...] introduces students to the content of science, including the process of investigation, in the context of the reasoning that gives science its dynamic character and provides the logical framework that enables one to understand scientific innovation and evaluate scientific claims. Inquiry is not process versus content; rather it is a way of learning content.

The National Research Council (2000) identified five attributes of *learners* in Inquiry Based Education 1) Engages in scientifically oriented questions, 2) Gives priority to evidence in responding to questions 3) Formulates explanation from evidence, 4) Connects explanations to scientific knowledge, and 5) Communicates and justifies explanations. However defining inquiry-based *teaching* approaches can be problematic, in particular there is considerable debate about the role played by the teacher in constraining or offering opportunities for learner decision making (Asay and Orgill 2010). In an attempt to identify approaches to inquiry that can foster creativity, Barrow (2010) mapped the five learner attributes of inquiry on a scale that indicates the level of pupil involvement/ decision-making or teacher guidance. This offers a tool for assessing inquiry (and teaching approaches). See Table 1 below. Barrow discusses how this scale reflects teacher approaches that range from pupil-directed open inquiry approaches, to guided inquiry approaches, and ultimately teacher directed 'cookbook' approaches. The implication of this scale is that greater learner self-direction offers greater scope for development and demonstration of skills and processes associated with inquiry and opportunities for creativity.

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Table 1: Essential features of classroom inquiry and their variations

Essential Feature			Variations	
Learner engages in scientifically orientated questions	Learner poses a question	Learner selects among questions, poses new questions	Learner sharpens or clarifies question provided by teacher, materials or source	Learner engages in question provided by teacher, materials and source
Learner gives priority to evidence in responding to questions	Learner determines what constitutes evidence and collects it	Learner directed to collect certain data	Learner given data and asked to analyse	Learner given data and told how to analyse
Learner formulates explanations from evidence	Learner formulates explanations after summarising evidence	Learner guided in process of formulating explanations from evidence	Learner given possible ways to use evidence to formulate explanation	Learner provided with evidence
Learner connects explanations to scientific knowledge	Learner independently examines other resources and forms links to explanations	Learner directed toward areas and sources of scientific knowledge	Learner given possible connections	
Learner communicates and justifies explanations	Learner forms reasonable and logical argument to communicate explanations	Learner coached in development of communication	Learner provided broad guidelines to sharpen communication	Learner gives steps and procedures to communication
More…………………………………………….Amount of Learner Self-Direction…………………………………………….Less				
Less…………………………………..Amount of Direction from Teacher Material……………………………….......More				

Essential features of classroom inquiry and their variations (Barrow, 2010, p. 3)

Different purposes of practical work

In deciding how far an open, guided or structured approach to inquiry is appropriate, a key consideration will be the purposes of the practical experiences provided. There are varied purposes for practical work, and it will not necessarily involve all features of inquiry or a complete investigation. Common purposes of practical work include:

- *Basic skills* – These activities can be used to develop skills and techniques such as selecting or using equipment, drawing graphs or measuring force or temperature.
- *Observations* – Observation activities can take a variety of forms involving: exploration, describing, sorting and classifying or noting similarities and differences. They can provide ways for pupils to use their knowledge and understanding to describe, identify or explain the important features of events or objects. They often act as a starting point for investigation, encouraging the formulation of questions, predictions or hypotheses.
- *Illustrations* – The purpose of this type of activity is to illustrate or demonstrate a concept so that pupils gain first hand experience of it. To achieve this illustrations are accompanied by detailed instructions that tell pupils for example: what to do, what equipment to use, what to measure, how many measurements to take. By following the instructions, it is hoped that all pupils reach the same end point and

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are able to see or experience the phenomenon that is the object of the lesson. This provides a basis for discussing or thinking about the phenomenon or introducing relevant concepts or scientific procedures. This is similar to 'structured' inquiry.
- *Investigations* – These can arise from play, chance events, statements from other pupils, pupils' questions or new science learning. During investigations, pupils apply and develop their existing understanding of scientific concepts and procedures. They should be able to make decisions about how to use practical skills and techniques, what equipment to use, what measurements to take and what means of recording results. Pupils should be involved in reviewing and offering explanations for results. These are the characteristics of 'open' inquiry-based approaches.

Developing understanding of the nature of science
In designing inquiry-based activities in science a further consideration is how they might support children's recognition of the varied ways in which scientists work and their wider understanding of the nature of science. The AKSIS project (Watson et al 1998) found that pupils often associated investigations with fair testing, and had limited awareness of the range of ways in which scientists work. Turner et al (2012) offer the following suggestions for the different types of inquiry young children might experience, that will involve different approaches to data collection and analysis:
- *Observing over time* for example: How do caterpillars develop over time?
- *Pattern seeking* for example: Do people with longer legs jump further?
- *Identifying, classifying and grouping* for example: What is this bird? Which materials are attracted to the magnet?
- *Comparative and fair testing* (controlled investigations) for example: Which is the best material for an umbrella?
- *Researching using secondary sources* for example: What are the different kinds of living things shown in fossils we have found?

Recent research by Akerson et al (2011) has also highlighted the potential in inquiry-based approaches for fostering children's understanding of the nature of science more generally, as discussed in Module 3 The Nature of Science.

What is the role of the teacher in inquiry-based approaches?
As noted in the Conceptual Framework adopted by the Creativity in Early Years Science Project (Creative Little Scientists, 2012: 52-55), there are debates therefore in the literature concerning the role of the teacher in Inquiry-Based Science Education (IBSE) in the early years, and the extent to which teachers are able to scaffold young children's problem finding and solving without hindering their agency. In this regard, it is helpful to consider the role the teacher can play in providing children with materials and activities, to foster shared and meaningful experiences. This reflects greater recognition of a more holistic approach in early learning that highlights the importance of the physical, social, and affective context in meaning-making. Providing children with shared, meaningful, physical experiences can offer them opportunities to develop their own questions as well as ideas about scientifically relevant concepts. In other words, by scaffolding the learning environment, it is possible to foster children's agency in problem identification and solving. In addition as highlighted by Fleer (2009), teachers play a fundamental role in mediating children's thinking between everyday experiences gained through playful interaction and more formal scientific concepts.

The challenge of achieving a balance between structure and freedom in early years educational settings should not be underestimated. The 'disciplined improvisation' (Sawyer,

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2004) of creative teaching, which may also be a feature of IBSE, makes high demands on teachers who seek both to utilise routines in the context of wider curriculum structures/ requirements and to work flexibly and responsively in order to offer opportunities to build new knowledge and understanding. Adopting a more dialogical approach in which the teacher orchestrates standing back with collaborative intervention in science classrooms represents a significant challenge.

Finally, as discussed in the module, the role of the teacher in inquiry-based approaches will vary over time in response to the purposes of the learning activities and the needs of the children, but with the long term aim of fostering children's independence and decision-making.

What are the issues for practitioners?

- Providing opportunities for child led or child initiated inquiries, building on their questions, ideas and experiences both in and outside school
- Giving attention to the full range of features of inquiry, recognizing young children's capabilities and creativity in both generating and evaluating ideas and strategies
- Sensitive intervention, deciding when to intervene and when to stand back to support children's decision-making and creativity.
- Developing confidence in interpreting and adapting curriculum and planning requirements to provide space for inquiry and flexibility to respond to children's interests and emerging capabilities
- Generating a rich and collaborative classroom environment to stimulate children's inquiry and creativity
- Capitalising on opportunities to foster children's understanding of the nature of science.

Overview of the module

The workshop consists of the following activities:

1. **Introduction to the module.** This is designed to outline the aims and rationale for the module. Features of inquiry, creative dispositions and the definitions of creativity used in CEYS are introduced. Some of the challenges of inquiry-based experiences are shared and discussed with participants if time.
2. **Sharing examples of practical activities you have carried out or observed in science**. This activity provides an opportunity for participants to record and compare examples of practical work they have experienced.
3. **Different purposes of practical work** – Participants are provided with possible purposes of practical work. They are invited to use this framework to group the activities they have recorded and reflect on opportunities they offer for inquiry skills and creative dispositions.
4. **Carrying out investigations**. Participants undertake investigations, keep notes of their progress, and share findings. They consider which inquiry skills were involved, and ways in which they were connected.
5. **Different types of investigation**: connections to the nature of science. This is designed to foster awareness of different ways in which scientists work and how this might be reflected in the classroom.
6. **Discussion of classroom examples** to examine – Which inquiry skills are involved? What opportunities are provided for children's decision making? How did the teacher seek to foster connections between the different phases of the investigation?

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7. **Reflection on opportunities for creativity and making links to the nature of science** in the classroom examples.
8. **Implications for future planning** from the module activities. Participants share examples.
9. **Reflection on what has been gained from the module** – both content and process, in relation to the aims of the workshop.

Module at a glance

Time	Task	Materials	Grouping
00.00	**1. Introduction** Rationale for the module – Widespread emphasis on inquiry-based approaches in international policy and increasing attention to the nature of science and to role of creativity in science. Overview of common challenges Aims of the module CLS Definitions of creativity, illustrations of varied opportunities for inquiry Overview of Module outline	PowerPoint presentation • Aims of the module • Module rationale • Links to Content Design Principles and Outcomes (CLS supporting material) • Inquiry skills and creative dispositions • CLS definitions of creativity in science • Illustrations of a variety of types of inquiry from CEYS Curriculum Materials. • Challenges for practitioners Flip chart to record any initial thoughts	Whole class
00.15	**2. Sharing examples of practical activities you have carried out/observed in science** *Working in 4s* *1. As an individual* – record examples of practical activities you have carried out/observed on separate post its and place on the A2 sheet on the table. *2. As a group* – See if you can sort these – Any common themes or differences? • What were the purposes of these activities (skills, processes, attitudes, knowledge and understanding in science)? • How far were decisions made by the children? • Note any issues raised. *3. Feedback to the whole group* Share some examples – range of contexts, purposes. Record any issues raised. Keep and display sheets for later.	Powerpoint of activity instructions Post its and coloured pens A2 sheets of paper for sharing responses. Flip chart and pens for recording issues	Groups of 4 Followed with feedback with whole class
00.35	**3. Different purposes of practical work** Introduce different purposes of practical work: basic skills, observation, illustration, investigation. *In groups of 4* Sort their examples of activities • What opportunities does each category offer for fostering inquiry skills and creative dispositions? • Which types of practical work were included? • Any implications for practice? • Any issues or questions? *Feedback to the whole group*	Powerpoint slides Types of practical work. Task instructions. Handout of the slides showing inquiry skills and creative dispositions and definitions of creativity for each group. Handout of the categories of practical work. Flip chart and pens for sharing responses	Whole class Followed by activity in original groups 4 Whole class conclusion

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	Share any issudes/implications Highlight the importance of children's decision making and greater opportunities for inquiry skills and children's creativity in investigations. The distinction between illustrative and investigative work reflects differences between open, guided and structured inquiry.		
00.50	**4. Carrying out investigations** *Working in 4s (rearrange groups if possible)* Participants undertake an investigation and keep notes of their progress. Examples need to cover different types of investigation (see the categories outlined in 5 below) and to allow progress over a limited time with limited equipment demands – possible examples include: *Do taller people have larger feet?* (pattern seeking) *Which ball is the best bouncer*? (comparative/fair testing). *Which materials let light through*? (sorting/classifying) Helpful if linked to local curricula. *Carry out your investigation* • Undertake the investigation provided • Keep notes of your progress and record results and conclusions for sharing with another group *Feedback to the whole group* • Approaches to data recording and analysis • Conclusions – comparing findings, evaluating evidence • *Range* of inquiry skills involved • Fostering inter-connections between inquiry skills across the investigation	Powerpoint slide of instructions Materials for practical investigations *Do taller people have larger feet?* Rulers tape measures, squared paper, pencils. *Which ball is the best bouncer?* Metre sticks, tape measures, variety balls and surfaces. *Which materials let light through?* Torches, variety of materials – transparent, translucent, opaque. Encourage participants also to improvise and try out materials around them. Variety of materials for recording results – pens, pencils, rulers, types/sizes of paper	Groups of 4 Whole group feedback
1.20	**5. Different types of investigation: connections to the nature of science.** Present varied types of investigation reflecting different ways in which scientists work in different domains • Sorting and classifying • Pattern seeking • Observing over time • Comparative and fair testing • Research using secondary sources Consider links to their own classroom examples Note it may depend on how the investigation is conducted and can shift over time – not just one answer!	Powerpoint presentation of investigation types	Whole group
1.30	**Break**		

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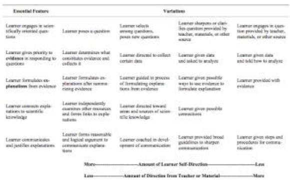
2.00	**6. Discussion of classroom examples** Introduce the classroom examples *Work in groups 4 –divide into two pairs* Provide each group with the different examples of Curriculum Materials for sharing but each pair starts by focusing on just one example in detail and review others briefly. 1. Read through first to gain an overview of the learning journey. 2. Then consider the following questions: • How did the investigations develop over time? How did they build on children's responses? • What opportunities were provided for children's decision-making and creativity? • What forms of recording were involved? How did they support learning? In what ways did the teachers foster connections between different features of inquiry *Feedback whole group* Brief feedback with whole group – opportunities within each episode/curriculum material - note key points. Consider types of practical work/investigations Scope for children's decision making (Barrow)	Powerpoint slides to introduce examples Task Types of practical work and investigations Barrow chart Copies of examples of Curriculum Materials from CEYS for example: Life cycle of a Frog Sounds around us Skeletons Recording sheet to note down analysis of examples Handouts: Types of practical work, Types of investigation Barrow chart 	Groups of 4/5 Followed with feedback with whole class
02.20	**7. Reflection on opportunities for children's creativity and for making links to the Nature of Science** Reminder definition of creativity in early years science from CLS and list of creative dispositions. Brief discussion in pairs of evidence of creative dispositions – followed by feedback of key points to the whole group. Introduction of features of the nature of science Whole group discussion – Collect comments from the whole group on a flipchart on potential to illustrate nature of science.	Powerpoint slides of definition of creativity in early science and list of creative dispositions Powerpoint slide of Nature of science (Akerson, 2012) Handouts of creative dispositions and Nature of science for participants to annotate and share in pairs. Flip chart and pens	Work in pairs/3s Whole group discussion
02.40	8. **Implications for future planning** *In pairs* Reflect on themes discussed across the module: • Clarifying different purposes of practical work • Recognising different ways of conducting investigations appropriate for different science content • Providing opportunities for children's creativity and decision making • Role of the teacher in supporting inquiry processes and creative dispositions Identify 2/3 implications for your future practice and any further questions/issues. Share examples of implications across the whole group.	Large sheet of paper Pens Markers	Groups of 2 Followed with feedback with whole class
2.50	**9. Reflections on what has been gained from the module**	Powerpoint slides of aims, session rationale and session	Sharing with the whole

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	• Think back to the start of the module and the different activities we have undertaken • In what ways did the activities support your developing thinking? • How far have the aims of the module been met?	outline Pens, post its Flip chart	class
3.00	**End**		

Teacher education pedagogy

1. **Introduction – aims and rationale for the module.** This module draws on key features of the Conceptual Framework adopted for the CEYS project (Creative Little Scientists, 2012), in particular definitions of: *learning activities* (associated with inquiry), *creative dispositions*, *creativity in science* and the *nature of science* (Akerson, 2012). The content reflects the widespread emphasis on inquiry-based approaches in policy internationally and growing emphasis on developing children's understanding of the nature of science as an important aim for science education. It introduces some key issues and debates in research and practice concerning what is meant by inquiry-based science or the nature of science and considers opportunities and challenges associated with implementing inquiry-based approaches in the classroom. If appropriate (in terms of time or audience) you could ask participants informally about their experiences – How far are inquiry-based approaches advocated or implemented in their settings? What are the issues? Were there any questions in their minds in coming to the session?

2. Sharing examples of practical activities you have carried out/observed in science. The purpose of this activity is to encourage participants to share, compare and reflect on their experiences of practical work in science. The activity can be interpreted in varied ways to suit different audiences. This could include activities they have planned or observed or their own experiences as pupils in school. Participants work in groups of 4. It is helpful to encourage them to come up individually with as many different examples as they can in a short time (2 minutes for example), recording each example on a separate post it and placing it on an A2 sheet for sharing with the group. Note the examples can be informal exploratory/play activities and well as more formal forms of practical work. Participants often gain from just hearing participants' different ideas. The next steps encourage participants to group the activities in their own ways and then to consider their purposes in terms of science learning and the extent of adult/child decision-making. This provides useful background information about participants' experiences that the module facilitators can build on across the session.

3. Different purposes of practical work. This takes the previous activity further by providing a framework for considering different purposes of practical work. Participants are then asked to use the framework to categorise their examples and to reflect on opportunities for inquiry and creativity. Depending on time, and responses to the previous task, this could be tackled in groups or with the whole group. It is helpful if the A2 posters are displayed and available to support participants' reflection across the module.

4. **Carrying out investigations**. The purpose of this activity is to provide experience of different types of inquiry in science and indicate the kinds of opportunities they might provide for discussing features of inquiry and illustrating the nature of science. Investigations often work best in groups of no more than 3 or 4 to foster active participation. It is helpful to organise the activity so that more than one group has carried out each

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investigation (and more than one type of investigation is included) so groups can compare approaches, results and conclusions. With limited numbers pattern seeking and fair testing offer useful contrasts. Emphasise that participants will have very brief opportunities to present and discuss their approaches and findings with peers. After 20 minutes groups who have undertaken different investigations pair up and review and evaluate their work. It will be important for the module facilitator to be alert to forms of recording possible/appropriate for the different types of inquiry as this often causes difficulty. It is helpful if the presenter encourages discussion of alternative approaches and findings, reflecting critical evaluation within a community – a key feature of creativity in science.

5. **Different types of investigation**, connections to the nature of science. This brief presentation to the whole group provides a framework for thinking about different types of investigation – emphasizing the need for children to experience different ways of doing science. (Note this list is not exhaustive – there are other possible categories discussed in the literature such as making things or modeling and there may be more than one possible approach in a particular context). Participants can be encouraged to reflect on connections to their own classroom examples discussed at the start of the module.

6. Discussion of Curriculum Materials from the CEYS project

The Curriculum Materials have considerable potential to foster interest and encourage debate about opportunities for fostering inquiry and building on children's ideas and questions *over time* in everyday classroom contexts. However participants may need support initially in engaging with the evidence shown in the Materials. It is helpful if the module facilitators are familiar with the background to the examples selected and provide a brief introduction to each one at the start of the activity. Make sure that the sheet providing background information is available to set the context for each example. It is best if participants work in pairs to discuss one example in detail focusing on the questions provided on the recording sheet for the activity. Towards the end of the time the pairs on each table swap examples and recording sheets and review other examples briefly – adding any thoughts they may have. In this way all participants are aware of all examples. In the feedback the module facilitator collates responses for the examples discussed.

7. Reflection on opportunities for children's creativity and making links with the nature of science. The purpose of this activity is to draw attention to the potential in inquiry-based approaches for fostering creativity and children's appreciation of the nature of science. Participants are given a short time to annotate their recording sheet used in reviewing the Curriculum Materials to highlight opportunities for fostering creative dispositions. Examples identified are shared briefly across the whole group.

This is followed by presentation of the poster showing features of the nature of science. Participants annotate a paper copy of the poster in pairs with opportunities to make links to the nature of science within their example, or given a short time to share orally, before whole group sharing of possible connections related to each example on a large version on a flip chart.

8. Implications for planning. Participants are invited to reflect in pairs on implications for their practice and any further questions they may have. It can be helpful to display the outline of the workshop and refer to any recording from activities on display round the room. Brief sharing of some examples across the whole group may prompt further ideas. This activity feeds into the final activity focused on reflection and evaluation.

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

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 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.

Nature of inquiry in early years science

The Conceptual Framework (D2.2) for the CLS project, also available on the CLS website at http://www.creative-little-scientists.eu/content/deliverables, has sections that refer to features of scientific inquiry and its role in science education:

B2.1.1 *Conceptualisations of science and mathematics education*: (32-34)

B2.1.2. *Capabilities in science and mathematics education*: (34-35)

B3 *Exploring teaching and learning with a focus on Inquiry Based Education (IBSE) and approaches that foreground creativity*. This draws out synergies between Inquiry-based and Creative approaches: (44-64)

Resources produced by the EU funded Fibonacci Project offer useful guidance and support related to inquiry-based learning http://www.fibonacci-project.eu in particular, *Learning through Inquiry* and *IBSE Self Reflection Tool for Teachers*.

Akerson, V., Weiland, I., Pongsanon, K. and Nargund, V. (2011) Evidence-based strategies for teaching Nature of Science to young children. *Journal of Kirsehir Education*, 11(4): 61-78.

This article suggests ways in which ideas about the nature of science can be integrated into classroom practice. It includes the poster summarizing features of the nature of science used in the module.

Turner, J. (2012). It's not fair! *Primary Science* 12: 30-33.

Provides an introduction to different types of inquiry in science.

Chapter 1 Science, learning and teaching, in Howe, A., Davies, D. et al (2009), *Science 5-11 a guide for teachers*, London: David Fulton provides a useful overview of perspectives on science learning and teaching including: the aims and purposes of primary science, the nature of science, processes related to scientific inquiry and different ways of working scientifically.

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Creativity in Early Years Science Education

Suggested classroom examples for use during the module

The following Curriculum materials from the *Creativity in Early Years Science Project at* http://www.ceys-project.eu act as useful starting points for discussion

Curriculum Materials

Title	Age group	Country
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

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
- Practical activities with list of resources – Do taller people have larger feet? Which ball is the best bouncer? Which materials let light through?
- Recording sheets for the different activities:
  - Task 6: Discussion of classroom examples
- Handouts
  - Task 3 Definitions of creativity in early years science, features of inquiry and creative dispositions
  - Task 3 Different purposes of practical work
  - Task 5 Different types of investigation
  - Task 6 Barrow Chart
  - Task 7 Features of the nature of science

References

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Barrow, L. H. (2010). Encouraging creativity with scientific inquiry. *Creative Education, 1* 1-6.

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Drayton, B., and Falk, J. (2001). Tell-tale signs of the inquiry-oriented classroom. *NASSP Bulletin, 856*(23), 24-34

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