Enabling Creativity and Inquiry through Science and Mathematics in Early Years Education

What have we learned?
The Final Report

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Presentation outline

• Background to the ‘Creative Little Scientists’ project
• What do we mean by creativity in early years science and mathematics?
• Potential for creativity and inquiry in policy and practice
  – Findings from policy and teacher surveys
  – Findings from fieldwork in schools
• Implications – practices, teacher education, policy.
Background to the project

Context

Importance of early years science
- Rationale for science education
- Changing perspectives on young children
- Aims for science education in the early years

New insights into learning and teaching
- Perspectives on science development and learning
- Role of the teacher – environment, scaffolding
- Assessment – new roles and priorities

Issues in policy and practice
- Challenges of inquiry-based approaches
- Beyond the rhetoric of creativity – reviewing potential
- Changing policy climate across Europe
Background to the project

Research Questions

1. How are the teaching, learning and assessment of science and mathematics in Early Years in the partner countries conceptualised by teachers and in policy? What role if any does creativity play in these?

2. What approaches are used in the teaching, learning and assessment of science and mathematics in Early Years in the partner countries? What role if any does creativity play in these?

3. In what ways do these approaches seek to foster young children’s learning and motivation in science and mathematics? How do teachers perceive their role in doing so?

4. How can findings emerging from analysis in relation to questions 1-3 inform the development of practice in the classroom and in teacher education (Initial Teacher Education and Continuing Professional Development)?
Background to the project

Project Partners

The project CREATIVE LITTLE SCIENTISTS has received funding from the European Union’s Seventh Framework Programme (FP7/2007-2013) for research, technological development and demonstration under grant agreement no 289081.
Background to the project

Project Processes

- Conceptual framework
- Research Questions
- List of Mapping and Comparison Factors
- Policy and teacher surveys
- Comparative Report
- Report of practices: Fieldwork in schools
- Guidelines for teacher training
- Exemplary training materials
- Final Report & Recommendations

The project CREATIVE LITTLE SCIENTISTS has received funding from the European Union’s Seventh Framework Programme (FP7/2007-2013) for research, technological development and demonstration under grant agreement no 289081.
What do we mean by creativity in early science?

Synergies and Differences between IBSE and CA
What do we mean by creativity in early science?

Comparing IBSE and CA

Inquiry-based Science Education
• Widespread promotion of IBSE
• Varied definitions – what scientists do, how students learn, pedagogical approach
• Features include: questioning, giving priority to evidence, formulating explanations & connecting to scientific knowledge, communicating and justifying explanations
  (for example Minner et al 2010)

Creative Approaches
• Problem finding & problem solving, playful exploration, individual, collaborative and communal engagement
• Roles of innovation, originality, ownership and control, connection making
• Involves risk taking, independent judgment, resilience
• Importance of intrinsic motivation, curiosity
  (for example Chappell et al 2008)
What do we mean by creativity in early science?

Synergies between Inquiry-Based and Creative Approaches

- Play and exploration
- Motivation and affect
- Dialogue and collaboration
- Problem solving and agency
- Questioning and curiosity
- Reflection and reasoning
- Teacher scaffolding and involvement
- Assessment for learning
What do we mean by creativity in early science

Creativity in learning

Factors from the Conceptual Framework (Creative dispositions)

• Sense of initiative
• Motivation
• Ability to come up with something new
• Ability to connect what they have learnt during lessons with topics in other subjects
• Imagination
• Curiosity
• Ability to work together
• Thinking skills
What do we mean by creativity in early science?

Creativity in early science and mathematics

DEFINITIONS OF CREATIVITY

Little c creativity

Purposive imaginative activity generating outcomes that are original and valuable in relation to the learner.

Creativity in Science and Mathematics

Generate alternative ideas and strategies as an individual or community, and reason critically between these.
Background to the project

Project Processes

- Conceptual framework
- Research Questions
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- Final Report & Recommendations

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## Discussion of Findings

### Strands and Dimensions (1)

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Aims/Purpose/Priorities</strong></td>
<td>Rationale or vision: Why are children learning?</td>
</tr>
<tr>
<td></td>
<td>Aims and Objectives: Toward which goals are children learning?</td>
</tr>
<tr>
<td><strong>Teaching, Learning and Assessment</strong></td>
<td>Learning activities: How are children learning?</td>
</tr>
<tr>
<td></td>
<td>Pedagogy: How is the teacher facilitating learning?</td>
</tr>
<tr>
<td></td>
<td>Assessment: How to measure how far children’s learning has progressed?</td>
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</tbody>
</table>
## Discussion of Findings

### Strands and Dimensions (2)

<table>
<thead>
<tr>
<th>Conceptual Framework Strands</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contextual factors</strong></td>
<td><strong>Content: What are children learning?</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Location: Where are children learning?</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Materials and resources: With what are children learning?</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Time: When are children learning?</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Grouping: With whom are children learning?</strong></td>
</tr>
<tr>
<td><strong>Contextual factors TEACHERS</strong></td>
<td><strong>Teacher Personal Characteristics</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Teacher General Education and Training</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Teacher Science and Mathematics Knowledge, Skills and Confidence</strong></td>
</tr>
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<td></td>
<td><strong>Initial teacher training</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Continuing Professional Development</strong></td>
</tr>
</tbody>
</table>
1. How are the teaching, learning and assessment of science and mathematics in Early Years in the partner countries conceptualised by teachers and in policy? What role if any does creativity play in these?
Discussion of Findings: Policy and Teacher Surveys

Scope

Policy Survey (over 100 policy documents)
• Policy documents related to Curriculum, Assessment and Pedagogy in Mathematics and Science in each partner country
• Documents for both Pre-school and Primary school
• Included both statutory requirements and guidance for teachers

Teacher Survey in 9 languages (815 participants)
• 348 Pre-school teachers
• 467 Primary school teachers
Factors from the Conceptual Framework

- Knowledge and understanding of science content
- Understanding about scientific inquiry
- Science process skills
- Capabilities to carry out scientific inquiry
- Social factors
- Affective factors
- Creative dispositions
Aims and Objectives

• Main emphases on cognitive dimensions
  – Process skills
  – Understanding scientific ideas

• Limited attention to
  – social and affective dimensions
  – nature of science

• Role for creativity in relation to investigating, curiosity

• Limited emphasis on creativity in developing scientific ideas
## Teacher Survey Findings

### Aims and objectives

<table>
<thead>
<tr>
<th>Aims and objectives</th>
<th>Never - 1</th>
<th>Rarely - 2</th>
<th>Quite often - 3</th>
<th>Very often - 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>To have positive attitudes to learning.</td>
<td>1.77%</td>
<td>26.84%</td>
<td>71.09%</td>
<td></td>
</tr>
<tr>
<td>To be able to ask a question about objects, organisms, and materials.</td>
<td>1.11%</td>
<td>33.56%</td>
<td>60.91%</td>
<td></td>
</tr>
<tr>
<td>To be interested in science.</td>
<td>0.88%</td>
<td>34.93%</td>
<td>60.70%</td>
<td></td>
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<tr>
<td>To have positive attitudes to science learning.</td>
<td>5.49%</td>
<td>35.86%</td>
<td>57.67%</td>
<td></td>
</tr>
<tr>
<td>To be able to collaborate with other children.</td>
<td>11.68%</td>
<td>41.61%</td>
<td>45.55%</td>
<td></td>
</tr>
<tr>
<td>To be able to employ simple equipment and tools, and tools used in investigations.</td>
<td>15.29%</td>
<td>39.41%</td>
<td>44.42%</td>
<td></td>
</tr>
<tr>
<td>To be able to communicate investigations and other children.</td>
<td>18.22%</td>
<td>41.67%</td>
<td>36.16%</td>
<td></td>
</tr>
<tr>
<td>To know and understand important scientific processes.</td>
<td>20.54%</td>
<td>43.22%</td>
<td>33.8%</td>
<td></td>
</tr>
<tr>
<td>To know and understand the important scientific processes.</td>
<td>21.42%</td>
<td>42.69%</td>
<td>31.11%</td>
<td></td>
</tr>
<tr>
<td>To be able to plan and conduct a simple investigation.</td>
<td>23.11%</td>
<td>43.60%</td>
<td>29.80%</td>
<td></td>
</tr>
<tr>
<td>To understand that scientists develop explanations.</td>
<td>28.30%</td>
<td>38.17%</td>
<td>26.12%</td>
<td></td>
</tr>
<tr>
<td>To understand that scientific investigations involve...</td>
<td>30.74%</td>
<td>38.17%</td>
<td>22.08%</td>
<td></td>
</tr>
<tr>
<td>To understand that scientists describe the...</td>
<td>43.59%</td>
<td>37.37%</td>
<td>28.42%</td>
<td>14.73%</td>
</tr>
</tbody>
</table>

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Teacher Survey Findings

Aims and Objectives

Differences between partner countries

Mean of a. To know and understand the important scientific ideas (facts, concepts, laws and theories).
Factors from the Conceptual Framework

• focus on cognitive dimensions, such as:
  – questioning
  – designing or planning investigations
  – gathering evidence, e.g. observing, running experiments (using equipment, manipulating materials, collecting data)
  – making connections

• focus on social dimensions, such as:
  – explaining evidence
  – communicating explanations
Learning activities

- Observing, communicating and questioning (pre-school) most emphasised
- Some emphasis on investigating and use of equipment (in primary)
- More varied emphasis on planning investigations or using data to construct explanations.
Teacher Survey Findings

Learning activities

1. Observe natural phenomena such as the weather or a...
   - Never - 1: 43.7%
   - Rarely - 2: 39.02%
   - Quite often - 3: 56.62%
   - Very often - 4: 56.62%

2. Ask questions about objects, organisms, and events in the...
   - Never - 1: 6.99%
   - Rarely - 2: 47.53%
   - Quite often - 3: 45.21%
   - Very often - 4: 27.41%

3. Communicate the results of their investigations and...
   - Never - 1: 20.25%
   - Rarely - 2: 49.04%
   - Quite often - 3: 27.41%
   - Very often - 4: 20.00%

4. Employ simple equipment and tools to gather data and...
   - Never - 1: 24.83%
   - Rarely - 2: 52.69%
   - Quite often - 3: 20.00%
   - Very often - 4: 17.17%

5. Conduct simple investigations or projects.
   - Never - 1: 30.47%
   - Rarely - 2: 49.72%
   - Quite often - 3: 17.17%
   - Very often - 4: 15.56%

6. Use data to construct reasonable explanations.
   - Never - 1: 29.72%
   - Rarely - 2: 50.83%
   - Quite often - 3: 15.56%
   - Very often - 4: 13.58%

7. Design or plan simple investigations or projects.
   - Never - 1: 35.25%
   - Rarely - 2: 47.60%
   - Quite often - 3: 13.58%
   - Very often - 4: 13.58%
Factors from the Conceptual Framework

- Play and exploration
- Motivation and affect
- Dialogue and collaboration
- Problem solving and agency
- Questioning and curiosity
- Reflection and reasoning
- Teacher scaffolding
Pedagogy

• Common emphasis on
  – Play, autonomous learning in preschool
  – Problem solving and children trying out ideas
  – Promoting inquiry skills

• More limited attention to affective and social dimensions
  – Varied contexts for learning – drama, history, field trips
  – Reflection or connecting explanations to scientific ideas
  – Role of imagination or discussion of alternative ideas
### Teacher Survey Findings

#### Pedagogy

<table>
<thead>
<tr>
<th>Activity</th>
<th>Never - 1</th>
<th>Rarely - 2</th>
<th>Quite often - 3</th>
<th>Very often - 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building on children’s prior experiences</td>
<td>17.7%</td>
<td>38.69%</td>
<td>56.13%</td>
<td></td>
</tr>
<tr>
<td>Fostering collaboration</td>
<td>7.09%</td>
<td>36.63%</td>
<td>55.83%</td>
<td></td>
</tr>
<tr>
<td>Encouraging problem finding – e.g. children asking...</td>
<td>0.01%</td>
<td>40.94%</td>
<td>53.90%</td>
<td></td>
</tr>
<tr>
<td>Relating science to everyday life</td>
<td>5.48%</td>
<td>41.33%</td>
<td>52.89%</td>
<td></td>
</tr>
<tr>
<td>Fostering imagination</td>
<td>5.51%</td>
<td>41.43%</td>
<td>52.46%</td>
<td></td>
</tr>
<tr>
<td>Encouraging problem solving – e.g. children solving...</td>
<td>6.27%</td>
<td>41.19%</td>
<td>52.39%</td>
<td></td>
</tr>
<tr>
<td>Working in small groups</td>
<td>6.55%</td>
<td>43.93%</td>
<td>49.25%</td>
<td></td>
</tr>
<tr>
<td>Using questioning as a tool in science teaching</td>
<td>10.28%</td>
<td>44.11%</td>
<td>44.41%</td>
<td></td>
</tr>
<tr>
<td>Fostering classroom discussion and evaluation of...</td>
<td>9.32%</td>
<td>46.73%</td>
<td>42.26%</td>
<td></td>
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<tr>
<td>Physical exploration of materials</td>
<td>12.72%</td>
<td>46.79%</td>
<td>40.22%</td>
<td></td>
</tr>
<tr>
<td>Integrating science with other curricular areas</td>
<td>13.48%</td>
<td>46.91%</td>
<td>37.41%</td>
<td></td>
</tr>
<tr>
<td>Encouraging different ways of recording and expressing...</td>
<td>20.51%</td>
<td>40.12%</td>
<td>36.83%</td>
<td></td>
</tr>
<tr>
<td>Encouraging children to try out their own ideas in...</td>
<td>15.99%</td>
<td>47.09%</td>
<td>36.32%</td>
<td></td>
</tr>
<tr>
<td>Open/unstructured play</td>
<td>24.38%</td>
<td>39.18%</td>
<td>30.96%</td>
<td></td>
</tr>
<tr>
<td>Using outdoor learning activities</td>
<td>25.24%</td>
<td>42.70%</td>
<td>30.56%</td>
<td></td>
</tr>
<tr>
<td>Role/Pretend play</td>
<td>23.39%</td>
<td>38.71%</td>
<td>29.82%</td>
<td></td>
</tr>
<tr>
<td>Fostering autonomous learning</td>
<td>20.57%</td>
<td>49.78%</td>
<td>27.72%</td>
<td></td>
</tr>
<tr>
<td>Teaching science from stories</td>
<td>22.63%</td>
<td>48.83%</td>
<td>24.69%</td>
<td></td>
</tr>
<tr>
<td>Using digital technologies with children for science...</td>
<td>30.25%</td>
<td>42.47%</td>
<td>21.16%</td>
<td></td>
</tr>
<tr>
<td>Taking children on field trips and/or visits to science...</td>
<td>39.56%</td>
<td>39.83%</td>
<td>14.94%</td>
<td></td>
</tr>
<tr>
<td>Drama</td>
<td>42.98%</td>
<td>29.61%</td>
<td>13.50%</td>
<td></td>
</tr>
<tr>
<td>Using history to teach science (e.g. transport, the work...</td>
<td>37.60%</td>
<td>40.63%</td>
<td>13.02%</td>
<td></td>
</tr>
</tbody>
</table>
Teacher Survey Findings

Pedagogy

Differences between partner countries

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Factors from the Conceptual Framework

• **Assessment function/purpose**
  – formative (assessment for learning)
  – summative
  – recipient of assessment results

• **Assessment way/process**
  – Strategy
  – Forms of evidence
  – Locus of assessment judgment
Policy Survey Findings

Assessment

• Wide variation in extent of policy requirements
• Often lack of coherence between rationale and aims in policy and assessment requirements
• Greatest focus on scientific ideas.
• Some references to understandings and skills of inquiry
• Neglect of social and affective dimensions
• Limited guidance on assessment strategies
• Limited attention to multimodal assessment or involvement of children
Teacher Survey Findings

Assessment Purposes

Positive attitudes and increase of interest in science
- Not important - 1: 9.95%
- 2: 28.88%
- 3: 64.30%
- Very important - 4: 6.36%

Positive attitudes and increase of interest in learning science
- Not important - 1: 9.56%
- 2: 31.29%
- 3: 62.28%
- Very important - 4: 6.56%

Knowledge and understanding of scientific processes
- Not important - 1: 22.38%
- 2: 41.42%
- 3: 32.27%
- Very important - 4: 3.92%

Competencies necessary to carry out scientific inquiry
- Not important - 1: 26.32%
- 2: 39.12%
- 3: 30.59%
- Very important - 4: 4.05%

Knowledge and understanding of scientific ideas (facts, concepts, laws and theories)
- Not important - 1: 26.21%
- 2: 34.26%
- 3: 30.01%
- Very important - 4: 9.52%

Understandings about scientific inquiry (e.g. how science and scientists work)
- Not important - 1: 33.04%
- 2: 39.56%
- 3: 18.07%
- Very important - 4: 9.37%

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### Teacher Survey Findings

**Assessment Processes**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Never - 1</th>
<th>Rarely - 2</th>
<th>Quite often - 3</th>
<th>Very often - 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>During classroom interaction</td>
<td>44.68%</td>
<td>49.71%</td>
<td>40.14%</td>
<td></td>
</tr>
<tr>
<td>Using portfolios (collection of evidence of...)</td>
<td>13.22%</td>
<td>21.88%</td>
<td>35.98%</td>
<td>28.93%</td>
</tr>
<tr>
<td>Evaluating children’s pictures, graphs etc which...</td>
<td>8.14%</td>
<td>20.93%</td>
<td>44.48%</td>
<td>26.45%</td>
</tr>
<tr>
<td>Evaluating children’s relevant gestures or...</td>
<td>8.54%</td>
<td>23.71%</td>
<td>45.07%</td>
<td>22.68%</td>
</tr>
<tr>
<td>Using authentic problem-based tasks</td>
<td>11.57%</td>
<td>23.29%</td>
<td>46.74%</td>
<td>18.40%</td>
</tr>
<tr>
<td>Using questions in context</td>
<td>12.69%</td>
<td>21.04%</td>
<td>48.06%</td>
<td>18.21%</td>
</tr>
<tr>
<td>Children correcting each other's work and giving...</td>
<td>19.76%</td>
<td>29.57%</td>
<td>35.36%</td>
<td>15.30%</td>
</tr>
<tr>
<td>Asking each child to reflect on their own learning...</td>
<td>10.86%</td>
<td>32.74%</td>
<td>41.22%</td>
<td>15.18%</td>
</tr>
<tr>
<td>Using open question tests</td>
<td>27.41%</td>
<td>19.56%</td>
<td>38.96%</td>
<td>14.07%</td>
</tr>
<tr>
<td>Marking their homework</td>
<td>37.61%</td>
<td>27.16%</td>
<td>22.99%</td>
<td>12.24%</td>
</tr>
<tr>
<td>Using checklists to record observations of children</td>
<td>21.09%</td>
<td>34.07%</td>
<td>36.14%</td>
<td>8.70%</td>
</tr>
<tr>
<td>Using closed question tests</td>
<td>37.82%</td>
<td>34.53%</td>
<td>36.14%</td>
<td>22.87%</td>
</tr>
</tbody>
</table>
Factors from the Conceptual Framework

• Sense of initiative
• Motivation
• Ability to come up with something new
• Ability to connect what they have learnt during lessons with topics in other subjects
• Imagination
• Curiosity
• Ability to work together
• Thinking skills
Policy Survey Findings

Creative attributes in Assessment

• Limited emphasis on creative attributes
• Thinking skills mentioned in primary policy in majority of countries
• References to curiosity - greater in preschool
• Very little focus on sense of initiative or ability to come up with something new
Teacher Survey Findings

Creative attributes in Assessment

- **Ability to work together**
  - Never - 1: 36.22%
  - Rarely - 2: 36.28%
  - Quite often - 3: 61.62%

- **Ability to come up with something new**
  - Never - 1: 36.28%
  - Rarely - 2: 59.36%

- **Thinking skills**
  - Never - 1: 37.08%
  - Rarely - 2: 59.27%

- **Curiosity**
  - Never - 1: 36.03%
  - Rarely - 2: 59.04%

- **Imagination**
  - Never - 1: 34.83%
  - Rarely - 2: 58.53%

- **Sense of initiative**
  - Never - 1: 43.27%
  - Rarely - 2: 53.40%

- **Ability to connect what they have learnt...**
  - Never - 1: 39.31%
  - Rarely - 2: 52.17%

- **Motivation**
  - Never - 1: 45.12%
  - Rarely - 2: 50.80%
Policy and teacher surveys

Implications

• Potential for inquiry and creativity in early years science and mathematics
• Complex relationships between policy and practice and between different dimensions of policy
• Areas for further exemplification and support included:
  – social and affective dimensions of science learning
  – planning investigations and evaluating ideas and explanations
  – nature of science
  – approaches to assessment
  – multimodal approaches to representing and expressing ideas
  – scope for autonomy – for both children and teachers
2. What approaches are used in the teaching, learning and assessment of science and mathematics in Early Years in the partner countries? What role if any does creativity play in these?

3. In what ways do these approaches seek to foster young children’s learning and motivation in science and mathematics? How do teachers perceive their role in doing so?
Findings from fieldwork in schools

Research Instruments

1. Wider site context – policy, management, staff development etc.
2. Case pedagogical context – policy, space, records etc.
3. Case observation pedagogical interactions and outcomes
   – Core instruments: digital images, fieldnotes, audio recording, time line
   – Repertoire instruments: Laever’s scale, Fibonacci tools, conceptual drawing, teacher journals
Findings from fieldwork in schools

Data collection

• Schools to illustrate potential for creativity
• Diversity of intake and setting
• Visits over 4 days (over a period of time)
• Minimum 4 sites (schools/preschools) and 6 cases per partner
• 3 episodes per case (both science and mathematics)
• 71 case studies and 218 episodes.
Findings from fieldwork in schools
Episodes from the project

Key features of our findings:
• About the potential for creativity
• Children’s capabilities
• Factors that seem to contribute to opportunities for inquiry and creativity.
Learning Activities: Generating and Evaluating Ideas

- Observing and making connections most common
- Rich, motivating contexts important in generating and evaluating ideas, questions and interests.
- Purposes for inquiry were linked to children’s everyday experiences and scope for children’s decision making.
- Teacher’s role and flexibility to build on these, as well as in fostering the social dimensions of inquiry.
- Greater scope of child-initiated activity and creative engagement in preschool.
Episode Sand box: Making a wall
Episode Measuring Tables: Taking measurements to give the carpenter for their new tables
Episode Float and Sink: How can the dove rescue the little ant who fell into the river?
Findings from fieldwork in schools

Pedagogy

• Opportunities for play limited in primary.
• The roles of varied forms of representation (incl. ICT) and the processes of representation in developing children’s thinking needed greater recognition
• Few examples of use of outdoor resources/areas, more in preschool
• Assessment approach informal and formative, but limited involvement of children in assessment
Opportunities for play, exploration, planning investigations and problem solving
Rich materials, motivating contexts, scope for autonomy
Opportunities for reflection on learning

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Findings from fieldwork in schools

Emerging findings: potential for creativity

• Scope for autonomy across varied settings
• Opportunities for play, investigation and problem solving
• Rich materials and contexts for learning indoors and outdoors
• Strong focus on affective and social dimensions of learning

However
• Limited explicit attention to the nature of science although evidence of potential
• Approaches to assessment mostly implicit
• Further attention needed to varied modes of representing and expressing ideas and role in learning
• Influence of school, teacher and policy factors
Background to the project

Project Processes

- Conceptual framework
- Research Questions
- List of Mapping and Comparison Factors
- Policy and teacher surveys
- Comparative Report
- Report of practices: Fieldwork in schools
- Guidelines for teacher training
- Exemplary training materials
- Final Report & Recommendations

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Teacher Education Materials

• Curriculum Design principles and teacher outcomes for teacher education based on Creative Little Scientists findings

• Exemplar materials for use in teacher education related to each design principle
  – Selected episodes from fieldwork – with context and commentary illustrated by extracts from data
  – Classroom extracts, photographs, interviews

• Suggested approaches to using exemplar material

All materials will be available on Creative Little Scientists website:  www.creative-little-scientists.eu
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