Activity 11: Developing Reflective Practice:
Ranking Pedagogies, Scientific Enquiries, Working Scientifically

B2: There is a range of teaching and learning approaches		
BRONZE AWARD INDICATOR	SILVER AWARD INDICATOR	GOLD AWARD INDICATOR
There are some relevant teaching and learning approaches in science adopted by the science subject leader in response to class and school development targets. He/she is beginning to share these with colleagues.	There are several relevant teaching and learning approaches in science adopted by teachers across the school in response to school development targets. The science subject leader is pro-active in introducing new strategies.	There is a wide range of relevant teaching and learning approaches in science adopted by the whole school and shared with other schools. The science subject leader is pro- active in introducing new strategies and innovations.

Teachers use a variety of teaching, learning and assessment approaches to help children develop scientific understanding; but how often do you reflect on the impact of your choices and uses of pedagogies, types of scientific enquiries, assessment strategies and ways of supporting children to work scientifically?

Mapping the use of teaching, learning and assessment approaches across year groups through reflection-on-practice will enable you to identify areas of strength and gaps in provision to ensure children build scientific understanding by experiencing a broad range of learning opportunities.

Three sets of diamond-nine ranking cards are provided to support you to develop reflective practice with staff. Encourage colleagues to reflect in year group pairs/teams within staff meetings. Additional questions are provided to support further discussion.

Card Sets:

1. Set 1: To rank the types of pedagogies used throughout school.
2. Set 2: To rank the types of scientific enquiry used throughout school.
3. Set 3: To rank the ways in which you support pupils to work scientifically.

NB

Reflections and supporting evidence for this criterion often indicate that teachers are unsure how to identify and describe the type of strategies they use in their teaching. Sharing these activities with colleagues will support you to articulate the practice in your school and the impact of different strategies and identify new strategies to adopt.

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1. Which Pedagogy? Set 1 Cards

What is the impact of a particular pedagogy on children's engagement, attainment and abilities to make progress in science? Do some pedagogies dominant in a year group – which ones? Are there pedagogies you would like other year groups to develop to maximize children's engagement in science? You can use Set 1 cards and the diamond nine framework to map provision in the types of enquiry experienced by children in each year group.

Card Set	Teaching/Learning or Assessment Approach	Explanation
Set 1 Types of pedagogy	Talk	Talk is used to explore ideas and to plan, implement and evaluate investigations eg Talk Partners, discussion groups, argumentation, puppets. Science vocabulary is developed through use of vocabulary mats, dual language resources, graphic organisers, word banks, writing frames or science shirts.
	Drama/ Role-play	Children explore and investigate scientific ideas and the life and work of scientists through hot-seating, Mantle of the Expert, Expert Witness or drama scenarios created by their teacher.
	Experiential learning	Children explore, observe, raise questions and investigate through first-hand learning experiences in a range of (outdoor) learning environments.
	Formative assessment	Teachers use a range of strategies to capture prior learning and to assess progress: eg to identify misconceptions using questioning, concept cartoons, mind-maps or KWHL grids; to scaffold learning using questioning and feedback to evaluate progress using mini-plenaries. You could use Set 4 cards to explore this aspect of practice in greater depth.
	Higher-order Questioning	Questions can be categorised as lower order (requiring children to remember and recall facts) and higher order (requiring children to analyse and evaluate, to apply knowledge and skills, to synthesise ideas eg from a range of sources to create new possibilities).
	Multi-sensory Activities	Children use their senses to explore, observe, interact and make sense of their worlds, raising questions as a result of their sensory observations.
	Practical Investigations	Children are able to explore science and scientific ideas by engaging in hands-on enquiries. Teachers may model skills for children.
	Making Models	Children construct models to explain phenomena (eg digestion or to solve problems).
	Play	Children express curiosity and are encouraged to observe, explore and interact with phenomena and to engage with problems through playful exploration.
	Scientific Enquiries	Children carry out a range of enquiries: exploration, observation over time, identification and classification, problem-solving, controlling variables and research.
	Working Scientifically	With support, children explore and observe phenomena; they raise and investigate questions by planning and carrying out a range of scientific enquiries. They decide how to collect, record and evaluate data to help them to explain phenomena. You could use Set 3 cards to explore this aspect of practice in greater depth.

Additional question to discuss with colleagues:

- Do children in all year groups have opportunities to engage in science as a hands-on, multi-sensory activity?

- Is play used to develop aspects of science beyond EYFS?
- Do teachers provide opportunities for experiential learning?
- How is talk used in your school to develop scientific understanding and to enable children to reflect on their experiences?
- Do you use drama and role-play to enrich science provision?
- How are pupils with EAL or language specific difficulties supported to express and communicate their scientific understanding?
- What types of language support materials have you developed to support differentiation (Eg vocabulary mats, graphic organizers, writing frames).
- Does teachers' planning incorporate children's questions and interests in topics?
- Do teachers' ask open questions that promote different kinds of higher order thinking?
- How can you develop teachers' practice in the use of questioning to improve children's critical thinking?
- Do children carry out a broad range of enquiries in each year group?
- How do staff support children to work scientifically in each year group?

For further ideas and guidance see: Dr Lynne Bianchi & Rosemary Feasey. ***An A – Z Guide to Primary Science. Active Teaching and Learning. Approaches In Science***
Download free from:
http://epsassets.manchester.ac.uk/medialand/fascinate/documents/a-z-of-primary-science.pdf

2. Developing Reflective Practice: Types of Scientific Enquiry – Set 2 Cards

- Do you know if children in each year group are experiencing a broad range of scientific enquiries?
- Are all teachers confident to plan each type of enquiry with pupils?
- You can use Set 2 cards and the diamond nine framework to map provision in the types of enquiry experienced by children in each year group.

Set 2 Types of scientific enquiries	Exploring phenomena	Children use their senses to make observations during first-hand experiences. They raise questions about phenomena.
	Observing change over time	Children make observations to observe change over time. They devise ways to record their observations to collect data.
	Identification and classification	Children group their observations and/or data into related sets to support identification and classification.
	Surveys and pattern-seeking	Children carry out surveys to identify the occurrence of patterns. Eg to identify the differences between plants growing in sunny or shady areas.
	Problem-solving	Children use and apply their scientific knowledge to solve problems. This may involve a challenge in a 'cross-curricular context eg DT.
	Controlling variables	Children can identify variables and by controlling them they can measure their effects eg Which material is best to make a rainproof poncho for Ted Bear? Why?
	Research and synthesis	Children can use a variety of information sources to inform and support their investigations.
	Teacher-led enquiry	The teacher directs the whole process: deciding upon the question to be investigated; how to plan the investigation, what data to collect, how to collect and analyse the data, what conclusions to draw.
	Guided enquiry	Teachers share decision-making opportunities with children throughout an investigation. Children become increasingly independent, raising questions, planning investigations and deciding on ways to collect and analyse data.
	Child-led enquiry	Children raise questions and design investigations to answer their

		questions. They can work independently taking responsibility for decision-making. They can explain their understanding using evidence from enquiries. They reflect on their findings and progress with peers and may modify their investigations.

Additional question to discuss with colleagues:

- How do you ensure there is a balance in the types of enquiries children undertake across a year/ key-stage?
- Are there some types of enquiries teachers are not confident to develop with children?
- How can you support less confident teachers to build their confidence and ensure they plan and support children to experience a full range of scientific enquiries across a year?
- Are children given opportunities to raise questions and make decisions about how to carry out investigations?
- How can you support children to become increasingly independent and confident to carry out scientific enquiries?

For further ideas and guidance see: Jane Turner, Brenda Keogh, Stuart Naylor & Liz Lawrence. **It's not fair – or is it? A guide to teaching working scientifically,** available from ASE and Millgate House Education

3. Developing Reflective Practice: Working Scientifically – Set 3 Cards

- Do you reflect with teachers on how they support children to work scientifically?
- Are there aspects of working scientifically that some teachers find difficult to teach? If so, how, as a school could you support colleagues to develop these aspects to enhance practice?
- You can use Set 3 cards and the diamond nine framework to map provision in the ways in which teachers support children to work scientifically.

Set 3 Aspects of Working Scientifically	Observes scientific phenomena using senses, and may use simple equipment or sensors.
	Raises and investigates questions as a result of observations.
	Plans simple tests to investigate questions that may be raised by the child, the whole class, the teacher or through topic planning.
	Makes predictions based on observations, to provide tentative explanations before testing out ideas.
	Tests out ideas: eg with guidance or independently with peers.
	Collects data in different ways: eg by counting, comparing, ordering, ranking or by measuring and recording changes. Repeats investigation to collect data.
	Sorts and analyses data (findings) by grouping, making tables, graphs, pie charts to identify patterns.
	Evaluates evidence: through discussion with peers and teachers. Children may need to repeat readings or change aspects of the investigation.
	Identifies and works out ways to control variables and to measure their effects.
	Forms conclusions based on the evidence they have collected, sorted and analysed.

Additional question to discuss with colleagues:

- How and when are pupils observed to work scientifically?
- When observing science lessons how do you gather evidence that children are experiencing some of the following:
  - raising questions, responding to teachers' probing or higher order questions;

- pupils planning investigations to answer questions;
- observing: sorting, comparing, ordering, ranking, grouping, counting, measuring changes;
- predicting – based on observations;
- suggesting tentative explanations (hypothesising);
- testing ideas, modifying ideas;
- generating, sorting and analysing evidence as data;
- working with evidence to justify conclusions;
- explaining findings, presenting findings to others;