Farm-based inquiry science

Summary:

This best practice involves students from Key Stage 1 to Key Stage 4 in active, hands-on, outdoor inquiries that support the development of their inquiry skills and science subject knowledge via interaction with local city farms and farm-educators.

Aims:

Farm-based science inquiry provides valuable links to school curricula and authentic learning environments in order to develop students' subject knowledge in areas such as biology, ecology, biodiversity and food production. It aims to :

- Provide learning opportunities that are 'beyond the classroom', underpinned by theories of learning that stress the way such activities (including engaging in problem solving in a wide range of 'beyond school' environments) enhance learning by directly engaging learners in 'active' learning.
- To support students to make links between classroom science learning and science in the 'real world'/their lives by providing a 'real-life' context in which science matters.
- To raise and to give students the opportunity to undertake ethical inquiry into issues of worldwide significance/concern especially around sustainable futures in food production and food security, by involving young people in the realities of producing food.

Main activities:

Farm educators work with teachers to create and deliverinquiry-based sessions for students which are closely linked to the curriculum and in-school learning. The focus of the farm sessions is hands-on, active and engaging learning through a carefully structured programme that allows students to develop their critical questioning and inquiry skills whilst also reflecting on the science subject knowledge that they are drawing on and developing. There are often both pre- and post -visits by the farm-educator to the school which supports the flow of learning across both sites. Theory is carefully integrated into all the sessions and assessment is through observation and conversations with students about the key scientific concepts they are exploring.

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PATHWAY

Narrative:

Farm educators work with teachers to create and deliver inquiry-based sessions for students which are closely linked to the curriculum and in-school learning.

The focus of the farm sessions is hands-on, active and engaging learning through a carefully structured programme that allows students to develop their critical questioning and inquiry skills whilst also reflecting on the science subject knowledge that they are drawing on and developing.

Students are supported to undertake active, hand-on inquiries that involve collecting and analysing data from around the farm, for example using data loggers to gather environmental data or measuring populations and using quadrats.

"Learn about different survey techniques that can be used to measure population sizes or biodiversity (seasonal - may include a timed search, quadrats, small mammal trapping, reptile refugia). Work in groups and choose techniques to compare the biodiversity of two habitats on the farm and report back findings".

Farm-based inquiry not only links the classroom study of science to 'real-world' science as experienced and used by 'farmers' but also supports students to explore the links between the farm, their lives and science. The most obvious link is through food. This can be done with very young children using simple concepts such as 'where does my dinner come from?' right up to GCSE and A-level Science students who can explore for example the ethics of modern farming or the science of soil and crop survival.

"How do farm animals provide the food we eat and how should we care for them in return? In this workshop we investigate egg, milk, or wool production and explore the needs of animals through games and investigations."

"Children explore the farm's gardens and allotments and play games to learn about what plants need to grow and be healthy. This session encourages the children to use their senses and examine their local environment in a new way, encouraging teamwork and observational skills. To finish the workshop the children will sow seeds to care for at home."

Technology is used to support the recording of data/ observations e.g. digital cameras, video cameras, data-loggers, probes, sensors. Teachers and farm educators support students to draw on and develop their science subject knowledge in order to make sense of their data and analyse it.

Students can also undertake ethical inquiry into matters of both local and global significance, such as food security and in such controversial areas as GM food and climate research. Students gain the critical skills enabling them to engage in ethical debates, arguments, controversies and contests about science, and to engage with philosophical ideas and questions about science.

There are often both pre- and post -visits by the farm-educator to the school which supports the flow of inquiry learning across both sites.

End user - involved actors
Key Stage 1, 2 and 3 students
Students, teachers, farm educators

Location: Primary and secondary schools - City farms

Languages available: English

Where to find the application or case:
Vauxhall City Farm:
http://tinyurl.com/VCFschools
The Woodlands Trust:
www.thewoodlandsfarmtrust.org/educationatrc.htm

Duration: Variable:
one week to one term

Evaluation parameters:
Students enjoyment of and enthusiasm for science
The development of students' critical inquiry science skills
The extent to which links between schools and external sites of science learning can support IBSE.

Connection with the curriculum: There is growing interest in the UK in learning which takes place beyond the classroom. City/local farms provide sites of learning that give hands-on opportunities for students to explore the science curriculum in a real-life setting. Workshops run by farms include curriculum links to biodiversity, sustainability, life of animals and plants and soil chemistry.

There is also an increasing focus on healthy eating in schools (the Healthy Schools agenda) as part of a brief to encourage broadly more healthy lifestyles. Farms can also provide first hand resources for diet, food types and cooking techniques that can be integrated into the school science curriculum.

There is a growing political and social awareness about the distribution of food resources globally and the way climate change might influence how and where food is produced. This has prompted a sharper focus on the need to introduce young people to issues of food production, sourcing and distribution. City/local farms provide the stimulus for raising and undertaking ethical inquiries into food security.

The recent introduction of the Environmental and Land-based Science GCSE (OCR: www.ocr.org.uk/qualifications/type/gcse_2011/science/elbs/) is also particularly relevant. The GCSE focuses on the practical application of Science to the care of animals and the production of food with students studying topics such as:

Animal Husbandry
- the application of recent scientific advances to the breeding of livestock and animals
- welfareissues
- modern farmingmethods
- day to day care of animals

Plant cultivation
- soil and environmental factors affecting growth
- growing a healthycrop
- plant reproduction

Teachers' Competencies

1	subject matter/content knowledge	x
2	nature of science	x
3	Multidisciplinary	x
4	knowledge of contemporary science	x
5	variety of (especially student-centred) instructional strategies	x
6	lifelong learning	x
7	self-reflection	x
8	teaching/ learning processes within the domain	x
9	using laboratories, experiments, projects	x
10	common sense knowledge and learning difficulties	x
11	use of ICTs	x
12	knowledge, planning and use of curricular materials	x
13	Information and Communication Technologies with Technological Pedagogical Content Knowledge	x

Mapping best practices with main principles

PATHWAY

1. Building interest in natural science phenomena and explanations:

The hands-on outdoor learning is engaging and enables the students to develop a practical understanding of natural science phenomena by 'doing' and by linking learning to a specific site and subject areas of interest, such as animal care. Teachers and farm educators ensure links are made between in-school learning and the learning on the farm.

2. Building up informed citizens:
Students understanding the nature of Science & Science in society:

Students undertake ethical inquiry into matters of both local and global significance, such as food security and in such controversial areas as GM food and climate research. Students gain the critical skills enabling them to engage in ethical debates, arguments, controversies and contests about science, and to engage with philosophical ideas and questions about science.

3. Develop multiple goals:

- **understanding big ideas in science including ideas of science, and ideas about science**
- **scientific capabilities concerned with gathering and using evidence**
- **scientific attitudes**

Students can be supported to undertake active, hand-on inquiries that involve collecting and analysing data from around the farm, for example using data loggers to gather environmental data or measuring populations and using quadrats.

4. Understanding students' concepts and learning style about of science phenomena:

Theory is carefully integrated into the practical sessions by the teachers and farm-educators. Students are encouraged to discuss the science phenomena they are exploring and to explain in their own words the connections between science theory and farm practice. These discussions enable both students and teachers/farm educators to address misconceptions.

5. Relevance of the content to daily life of students:

Farm-based inquiry not only links the classroom study of science to 'real-world' science as experienced and used by 'farmers' but also supports students to explore the links between the farm, their lives and science. The most obvious link is through food. This can be done with very young children using simple concepts such as 'where does my dinner come from?' right up to GCSE and A-level Science students who can explore for example the ethics of modern farming or the science of soil and crop survival.

6. Understanding science as a process not as stable facts.
Using up to date information of science and education:

Sessions at the farm are kept up to date and are often based on contemporary scientific issues.

7. Activities for gaining knowledge, not for entertainment,
nor for simple imitating of results:

The activities are engaging and sometimes entertaining but the enhancement of science knowledge and scientific principles remain at the core of the activities.

8. Doing science: experimenting, analyzing, interpreting, redefining explanations:

Students undertake observations or data collection as part of their inquiries, often using ICT to support the recording of data e.g. digital cameras, video cameras, data-loggers, probes, sensors. Teachers and farm educators support students to draw on and develop their science subject knowledge in order to make sense of their data and analyse it.

9. Assessment:
formative ~ of students' learning and the summative ~ of their progress:

Teachers make explicit the learning that is happening within the investigations and students reflect on this. Whilst the students are involved in practical inquiries teachers and farm educators talk to pupils and listen to pupils talking to each other, matching their understanding to level descriptors.

10. Cooperation among teachers and with experts:

The farm educator and teacher plan the farm visit together to ensure there is meaningful continuity between the classroom and the outdoor learning site. Farm educators will often do a pre- and post-visit to the classroom, especially if the purpose of the visit is for the students to learn about growing so that they can grow their own plants/vegetables in school.