

STEM By Nature: An Introduction



STEM By Nature: STEM teaching & learning in nature settings, using outdoor learning approaches Guidance for a 2-3-hour training session

This session introduces and explores what is meant by 'STEM By Nature' and how it can be applied. It can be adapted to suit a range of locations and group/learner needs. Its audience is teachers and other educators, including youth workers, outdoor instructors, Countryside Rangers. Whilst some facilitation and group management skills are needed, it's designed to be delivered by non-specialists – you do not need to be an expert in STEM learning or the outdoors.

STEM By Nature Introduction – Aims

- Build STEM skills and confidence through use of nature settings and outdoor learning approaches.
- Introduce the concept of STEM By Nature.
- Highlight Curriculum for Excellence, STEM, and Learning for Sustainability connections.
- Explore creativity in relation to STEM skills and nature settings.
- Demonstrate methods of pupil/learner enquiry.
- Highlight examples and opportunities for Interdisciplinary Learning.
- Address gender/equity in relation to outdoor settings.

Structure and Content

This introductory session offers an overview of STEM By Nature. It highlights some learning contexts and themes that are relevant to a range of STEM subjects, including:

- Employability skills
- Learning for Sustainability as a Curriculum for Excellence entitlement
- UN Sustainable Development Goals
- Nature Connection
- Pupil/learner enquiry
- Refreshed curriculum narrative and Interdisciplinary Learning
- Creativity
- Gender and equity

This introductory session is part of a growing portfolio of STEM By Nature session guidance hosted on the John Muir Trust website [here](#). Other sessions in the STEM By Nature series include: Citizen Science: #14 Life Below Water, Citizen Science: #15 Life on Land, UN Sustainable Development Goals and #13 Climate Action. Explore the STEM By Nature [Resources and Links padet](#) which has useful links relating to each relevant UN Sustainable Development Goal. See [here](#) for session guidance for STEM By Nature: Trees, Woods and Forests, created by Rob Bushby for Scottish Forestry.

Introduction

Welcome and context setting

As participants gather, set an ice-breaking task with an open leading question such as:

- 'What do you do in relation to STEM at your establishment?'
- 'Do you currently deliver anything in outdoor settings?'

Collate responses on flip chart, share with group.

Introduction to STEM By Nature, its origins and rationale

Introduce STEM By Nature as 'STEM teaching & learning in nature settings, using outdoor learning approaches'.

Outline session aims and objectives, as above.

Note the inclusive 'educator' audience; the session and associated guidance can have relevance to a wide range of ages and backgrounds, not just schools/teachers.

Note any relevant local links to Outdoor Learning, STEM, Citizen Science, #15 Life On Land resources; acknowledge any relevant expertise within group (and incorporate as appropriate).

Learning contexts and themes

Introduce relevant contexts and themes to STEM By Nature and use the time outdoors to integrate discussion and reflection at suitable points. Note that this session is anchored by **Nature**

Connection and that other sessions are available to explore particular themes in more depth.

STEM

STEM (Science, Technology, Engineering, and Maths) is an integral part of future economic and social development. STEM is an important context for learning, teaching critical thinking skills and passion for innovation.

Scotland has set out an ambition as a STEM nation:

"with a highly educated and skilled population equipped with the STEM skills, knowledge and capability required to adapt and thrive in the fast-paced, changing world and economy around us"¹.

For a summary of STEM resources see [here](#).



¹ [STEM Education and Training Strategy for Scotland](#).

Employability Skills

STEM goes beyond learning in subjects and assists in the development of skills that fuels success across a variety of tasks and disciplines. Introduce [STEM employability skills](#) (above) and ask participants to consider how progression in these skills can be observed/developed as we engage in activities outdoors. Review at end of session. See *STEM By Nature: Skills and Enquiry* [handout](#).

Learning for Sustainability

Use the Learning for Sustainability [Word Cloud](#) to consider and explore its relevance to STEM By Nature. Learning for Sustainability is a Scottish educational approach to learning that encourages learners and educators to explore the concepts of sustainable development, global citizenship and outdoor learning in ways which develop the skills, knowledge and values needed to live sustainable lifestyles. At its most effective, it is delivered across the curriculum and extends to influence the life and ethos of an educational setting. There is strong evidence of the effectiveness of



Learning for Sustainability in developing pro-environmental attitudes and behaviours, and that it has an impact on broader educational outcomes. Learning for Sustainability is aligned to the United Nations Sustainable Development Goals, offering a starting point to explore local issues within a global context and vice versa. It is an entitlement of all pupils, a professional registration requirement of the General Teaching Council for Scotland, and currently a priority in Scottish education.

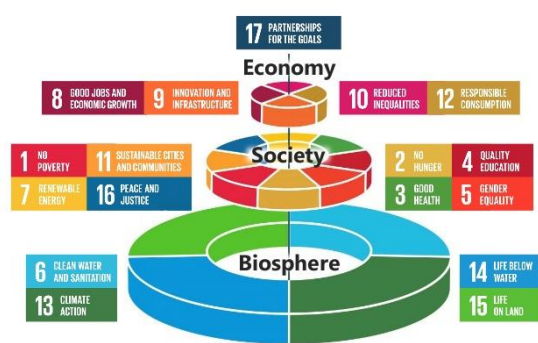
Reference: [The Impact of Learning for Sustainability on Educational Outcomes: A Summary of Findings](#) and [A summary of Learning for Sustainability resources](#)

UN Sustainable Development Goals

Ask participants which UN Sustainable Development Goals relate to STEM By Nature; share this [Biosphere](#) model of how they can be seen to interconnect.

STEM By Nature sessions can be set up to link STEM learning with specific Sustainable Development Goals and related initiatives e.g. land-based surveys, trees and woodland studies (Citizen Science), Climate Ready Classrooms, Year of Coasts and Waters. It can be set in a context of one or more UN Sustainable Development Goals e.g. #14 Life Below Water, #15 Life on Land, or other relevant Goals relating to ecological and sustainability issues.

Reference: [Sustainable Development Goals](#) See *STEM By Nature & UN Sustainable Development Goals* [handout](#).



STEM, Outdoor Learning and nature

The most urgent, challenging issues for individuals and society, locally and globally, have STEM and nature at their core, helping with our understanding of the problems and identifying potential solutions. Taking learning outdoors engages people in active ways and gives opportunities for learning in real life contexts. Nature provides rich, multi-sensory experiences that can be a catalyst for curiosity and an important starting point and context for STEM learning.

Nature Connection is good for us, with potential for vitality, purpose and happiness (see summary of benefits in [Noticing Nature](#) p.41). Nature connection and pro-environmental behaviours that can result are also good for the planet. Nature experiences can impact on values, reinforcing concern for issues such as biodiversity loss and climate change and motivations towards environmentally friendly lifestyles.

Introduce *five pathways to nature*

connection: ‘a route for new closer, healthier and more sustainable relationship with nature comes through noticing, feeling, beauty, celebration and care’.

See [The Pathways to Nature Connectedness postcard](#) for the framework and some things to try.

The Pathways to Nature Connectedness		...for a new relationship with nature	
As humans our story is nature. Our relationship with the rest of nature matters for our well-being, yet the climate and environment emergency shows that the human relationship with the rest of nature is broken. To fix it we need a new more connected relationship that recognises that we are part of nature. A relationship that brings both pro-nature behaviours and improved mental wellbeing. The pathways to nature connectedness provide a route for people to develop that new relationship. A new relationship with nature that moves away from utility and control, beyond knowledge and identification. A new closer, healthier and more sustainable relationship with nature comes through noticing, feeling, beauty, celebration and care.			
Pathway	This pathway is about...	We're encouraging everyone to...	Things you can try...
Contact	Tuning in to nature through the senses.	Notice and actively engage with nature, spending time fully experiencing nature with all their senses.	Listening to birdsong, smelling wild flowers, watching the breeze in the trees, going barefoot, tasting the fruits of nature.
Emotion	Feeling alive through the emotions nature brings.	Engage emotionally with nature. To find happiness and wonder in nature. To note the good things in nature, the joy and calm that they can bring. To embrace nature at times of sorrow.	Finding joy in wildlife at play, taking a moment to feel calm with nature. Find wonder in a spiders' web. Reflect and share your feelings about nature with others.
Beauty	Noticing nature's beauty.	Find beauty throughout the natural world. Every day, take time to appreciate beauty in nature, engage with it through art or in words.	Create some wild art, paint the amazing colours of insects, take a photo of a flower, visit a place with an amazing view.
Meaning	Nature bringing meaning to our lives.	Explore and express how nature brings meaning to their lives. To notice how nature appears in songs and stories, poems and art. How special places are natural spaces. To celebrate the mystery, signs and cycles of nature.	Create a story about a tree, map the journey of a bee, find folktales about nature, celebrate the longest day, the first swallow of summer or the first fall of leaves. Let nature be your story.
Compassion	Caring and taking action for nature.	Think about what they can do for nature. To take actions that are good for nature. Recognise shared life stories and be part of the community of nature.	Feed the birds, plant some wildflowers, take part in a beach clean, dig a pond, put up a nest box, watch a wild family grow. Support conservation charities or buy eco-friendly products.

UNIVERSITY OF DERBY
Nature Connectedness Research Group
Good for nature. Good for you.
Nature is our story
derby.ac.uk/NCRG

Pupil/Learner enquiry

Ask practitioners what they understand by pupil/learner enquiry, and what techniques and activities they have used to promote it.

It's an approach where learners decide for themselves, ask their own questions and carry out their own independent investigations. It is typically active and learner-centred, with practitioners taking on a facilitator role to develop skills (e.g. information processing, problem solving) and nurture inquiring attitudes. See *STEM By Nature: Skills and Enquiry* [handout](#).

Curriculum for Excellence refreshed curriculum narrative and 4 contexts.

As part of their learner journey, all children and young people in Scotland are entitled to experience a coherent curriculum from 3 to 18, in order that they have opportunities to develop the knowledge, skills and attributes they need to adapt, think critically and flourish in today's world.

Curriculum is defined as the totality of all that is planned for children and young people from

Outdoor Learning across the four contexts

Opportunities for personal achievement

Children at all levels can engage in a variety of awards

RSPB Wild Challenge, Heritage Hero Award, John Muir Award, Gardening Award, Duke of Edinburgh Award...

<https://blogs.glowscotland.org.uk/en/learningoutdoorspage/learningsupportteam/learning-at-home/>

Interdisciplinary Learning

Books are a great way to share learning across lots of different subject areas-

The Lorax - book study
<https://blogs.glowscotland.org.uk/en/learningoutdoorsupportteam/the-lorax-literacy-activities/>

The Owl who was afraid of the dark
<https://blogs.glowscotland.org.uk/en/learningoutdoorsupportteam/the-owl-who-was-afraid-of-the-dark/>

Ethos and life of the school as a community

Pupils involved in design of school grounds using audit tools -
<https://blogs.glowscotland.org.uk/en/learningoutdoorsupportteam/literacy-audit-and-pick/>

Pupils at Park Special School co-constructing their residential experience -
<https://learningaway.org.uk/case-studies/importance-learning-park-school/>

Curriculum areas and subjects

Learning maths at home outdoors:
<https://blogs.glowscotland.org.uk/en/learningoutdoorsupportteam/numeracy-and-maths/>

So much Science outside!
<https://blogs.glowscotland.org.uk/en/learningoutdoorsupportteam/science/>

Feel good with Health and Wellbeing activities linked to some great books
<https://blogs.glowscotland.org.uk/en/learningoutdoorsupportteam/health-and-wellbeing/>

The Curriculum: "the totality of all that is planned for children and young people throughout their education"

early learning and childcare, through school and beyond. That totality can be planned for and experienced by learners across four contexts:

- **Personal Achievement:** links are made through STEM By Nature with the John Muir Award and Young STEM Leader Award.
- **Interdisciplinary learning** enables educators and learners to make connections across learning through exploring clear and relevant links across the curriculum. It supports the use and application of what has been taught and learned in new and different ways. It provides opportunities for deepening learning, for example through answering big questions, exploring an issue, solving problems or completing a final project. STEM By Nature offers rich potential for Interdisciplinary Learning.
- **Curriculum areas:** STEM refers to a collective of specific subjects (Science, Technology, Engineering and Maths). STEM By Nature embraces nature settings and outdoor learning approaches (whilst encouraging creativity and integrated use of the arts too).
- **Ethos & Life of the school:** STEM By Nature can be part of school wide Climate conversations, Eco-schools activity and use of the school grounds and local community.

Share the example of how Outdoor Learning can help to meet the four contexts. You can invite participants to use a [Templates](#) to outline how their school, programme of learning is meeting the four contexts of the curriculum. This can be done as a group discussion exercise.

Gender equity and STEM

Show 2 minute film about unconscious gender bias: [Inspiring the future: redrawing the balance](#).

Discuss how Improving Gender Balance and Equalities (IGBE) ties in with national priorities. Gender imbalance is a particular issue with STEM subjects and related employment opportunities. Show 1 min [Forces of Nature](#) film role modelling women in the outdoors.

Signpost [IGBE resources](#) on the National Improvement Hub. If possible, share some hard copies. Encourage practitioners to look at classroom/centre and outdoor interactions and complete a gender audit (of indoor and outdoor classroom/centre/relevant setting displays, gender ratios in activities/groups, and descriptive language used) as part of a local learning/homework ask. Present activities as introductions and 'tasters' rather than fully delivered, to keep within a limited

Outdoor Session

timeframe, to share a wide variety of ideas, and to give space to integrate and discuss elements noted above. Monitor opportunities to consider STEM Skills, methods of pupil/learner enquiry and interdisciplinary learning as they arise.

Icebreaker - Outdoor Learning journey

Ask participants to arrange themselves in a 'scale of experience' semi-circle, based on where they are in their own Outdoor Learning journey (using the outdoors frequently/ infrequently). Discuss briefly.

Nature Connection: Self-guided activity

Offer participants a selection of nature connection activities in a suitable outdoor settings. Examples can be found on the [Nature Pathways postcard](#), or via Mission:Explore ([Food](#), [Water](#), [John Muir](#)) e.g. walk barefoot in the grass, create a soundmap, hug a tree (see [Sharing Nature](#) for introductory video for these activities). Invite participants to reflect on benefits of noticing nature.

Creativity and STEM Learning

Frame activities in the context of using art and creativity in nature settings as part of STEM learning.

Introduce [The Lost Words](#) (see below) and The Lost Words [Explorer's Guide](#).

Read different poems aloud in groups. Also see companion book [The Lost Spells and seasonal Explorer Guides](#).

Find 1 or 2 suitable short activities e.g. write a collective group poem.

Reference: [OWL Tree Stories](#); [OWL Wolf Brother's Wildwoods](#)

Reference: [@STEAMFife](#), "Sharing and promoting all things to do with Science, Technology, Engineering, the Arts and Maths in Fife" and [STEAM Activities](#).

Review Session

Review each of the session's outdoor activities using the [STEM employability skills map](#) to highlight particular skills used and/or developed (add review notes to display board/flip chart as participants return indoors).

Open discussion/round robin: "What can you take away with you from this session?"

Introduce STEM By Nature [Information & Resources padlet](#): a place to collate relevant and referenced resources (along with other relevant locations of resources e.g. Glow).

Create a padlet to share participant conversations and activities.

Signposting & wrap up

Local learning task suggestions

Go outdoors and try some nature connection activities with your group.

Reflect on gender stereotypes in relevant indoor and outdoor settings.

Find an opportunity to share your learning with colleagues.

Share a photo/quote/tweet. Note use of relevant hashtags for social media sharing e.g.

[#STEMByNature](#).

Resources – links and signposting

Have hard copies of these resources available (or web access and links) for participants to view.

John Muir Award [Sustainability Resource Guide](#)

John Muir Award and [Curriculum for Excellence](#)

John Muir Award [Literacy & Nature Resource Guide](#) - highlights how nature and the outdoors can inspire and support literacy skills, and can easily be adapted for a STEM learning context.

[The Lost Words](#): Information & resources including free [Explorer's Guide download](#) plus [posters](#) of Dandelion, Otter, Kingfisher, Conker, Bramble; [Padlet](#) for sharing creative outputs; [#TheLostWords](#).

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