BLF Learning Framework

What is the BFL Learning Framework?

The learning framework is intended to support planning and reflection on what constitutes good biomimicry learning within a STEM and sustainability setting.

The learning framework presents four key areas to consider in developing biomimicry learning resources and programmes (see diagram 1 below). Each area represents a key aspect and is based on a driving question. Behind each driving question, detailed questions encourage deeper reflection and planning.

It is important when using the learning framework to consider the prior learning and attainment level of learners, and apply the learning framework accordingly. The current version of the learning framework does not provide for progression and this, along with learner differentiation, needs consideration by teachers and educators.

The four domains in the learning framework do not sit independent of one another. They should be seen as complimenting each other. For example, competences gained under the learning outcomes need to be supported by content, which is in turn applied through biomimicry thinking.

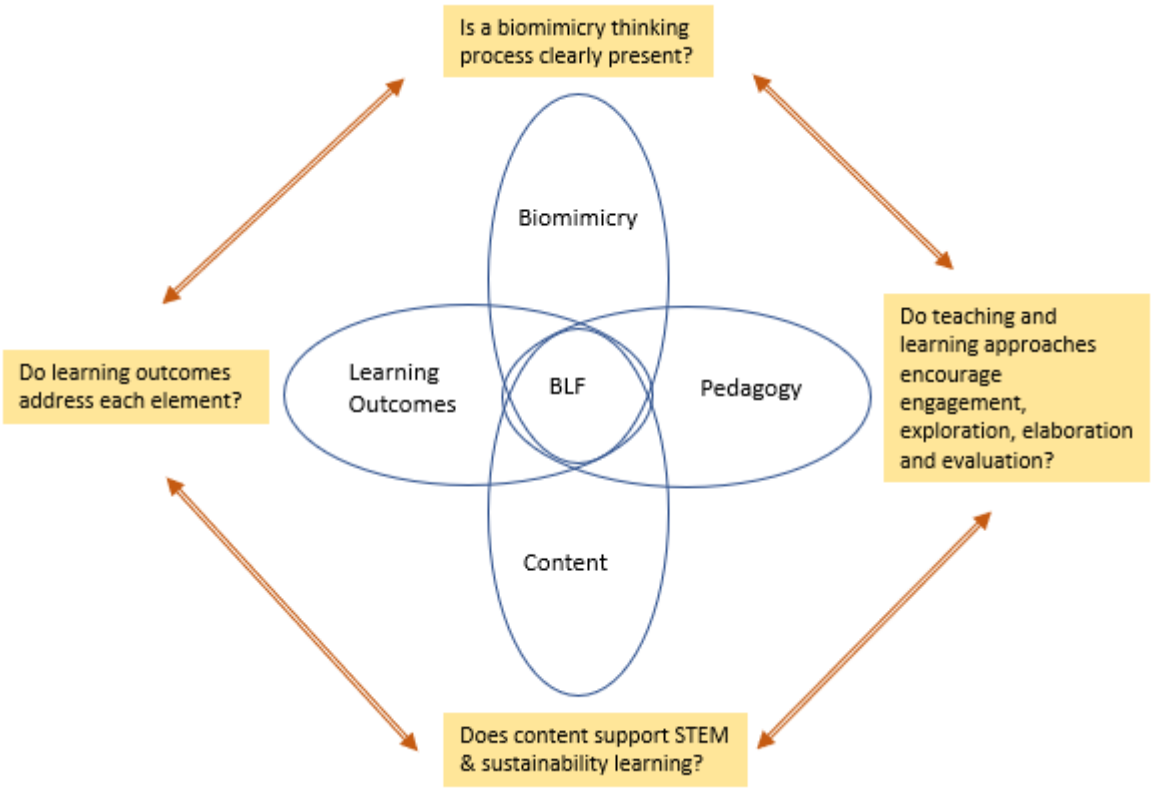

Diagram 1: BLF Learning Framework

Detailed Elements within the Learning Framework

Is a biomimicry thinking process clearly present?

The biomimicry process is based on the approaches of 'biology to design' or 'challenge to biology' (see Baumeister, 2014). Questions to consider include:

- Do activities connect learners with nature?
- Do activities encourage close observation of nature? (first-hand, images, video)
- Do activities reveal nature's talents and abilities? (function - strategy)
- Do activities provide connection between biological models and human design?
- Do activities provide opportunities to research or learn about natural examples?
- Do learning activities provide opportunities to create human designs based on nature?
- Do activities provide opportunity to reflect on and improve 'design' ideas?
- Do activities stimulate awe, wonder and respect for/about/in nature?
- Are biomimicry principles explored?

Does content support STEM and sustainability learning?

Each national curriculum will include their own content and standards relating to STE(A)M subjects, and these should be consulted. Here we are looking for broader themes to be present, and how these themes relate to the real lives of the learner. Questions to consider include:

- Does content encourage recognition that humans are a part of nature?
- Does content provide a relatable sustainability challenge?
- Is content strongly connected with a range of STE(A)M subjects?
- Can content be differentiated for pupil ability?

Do learning outcomes address each element?

Learning outcomes reflect what learners should be able to do by the end of the learning process; they represent the competences learners need to acquire in order the use biomimicry effectively. Competences to consider include:

- Observation – the ability to observe the natural (including humans) world closely and identify how it works.
- Curiosity – the ability to ask questions about the natural work, and to describe and draw it accurately.
- Problem solving – the ability to compare, explain, categorise and analyse in order to understand an issue and find solutions.
- Questioning – the ability to decide, prioritise, justify.
- Creativity – the ability to imagine, plan, design and relate (to something new).
- Connecting – the ability to relate content matter to personal interest, and to wider sustainability of natural systems which include humans.

Do teaching and learning approaches encourage engagement, exploration, explanation, elaboration and evaluation?

There is a strong inquiry strand to pedagogy based on the 5E's of inquiry-based learning (see Bybee et al, 2006). Pedagogical approaches should support these learning strategies. Questions to consider include:

- Engagement:
  - Is it hands-on?
  - Is the outdoors/natural world used for learning?
  - Is it inter-disciplinary?
  - Is it something pupils care about?
  - Are learners engaged in a topic of interest?
- Exploration:
  - Do learners elicit information and create ideas for themselves?
  - Are hands-on and minds-on learning used?
- Explain:
  - Can learners share their findings with others?
  - Can learners demonstrate understanding?
  - Can learners discover relationships between content?
- Elaboration:
  - Can learners put ideas into practice?
  - Can learners apply their learning?
- Evaluation:
  - Do learners reflect on their work?
  - Can they learn from 'mistakes'?

How to use the Learning Framework

Learning framework is based upon an experiential educational perspective; learning is the result of a construction of knowledge and understanding through direct experience. In this way, learning is seen as a journey of inquiry rather than a fixed destination, and within this journey learners build connections between and make meaning from their experiences. This approach, rather than just remembering facts, is particularly well suited to sustainability and applying biomimicry thinking to sustainability challenges. Empowering learners to make meaning from their experiences starts to equip them to transform their worldviews and behaviours.

The learning framework is not a tick-list; it is not a set of 'standards' or 'expectations.' Nor is the learning framework rigid and inflexible. Instead, think of it as a guide to which you can add your own ideas; make it your own and add your thoughts. Perhaps your sessions have a strong sustainability content but could benefit from more learning engagement? Perhaps you want to explore ways to connect natural history with human ingenuity? Exploring the learning framework can help provide ideas for session planning, and reflecting on sessions you have delivered.

Learning framework as a planning tool

The learning framework offers helpful guidelines for planning an experience, whether it is a single session/ lesson, a day or an entire course. The learning framework provides a degree of 'structure' if you want it, it is best used as a fluid, flexible guide rather than a fixed pro forma. This is especially the case when presented with days which have already been planned, outcomes which are predetermined or teachers who have a favoured approach. It is important to recognise that any

learning framework which is to be used by educators working with the formal sector must be able to accommodate these demands.

Within formal education, content connected with STEM and sustainability might be the starting point – what curriculum content can I connect with sustainability? This might lead on to considering how this content links with biomimicry as an approach to content delivery, and to inquiry-based pedagogies.

Non-formal programmes might start from learning outcomes – the competences we want learners to develop. This leads to reflection of the key pedagogies which will support development of these competences, and then how different biomimicry activities might enable these competences to develop.

There is no 'official' way to use the learning framework. Simply start from where seems logical, and then bring in the other elements, perhaps revisiting them several times during your planning.

Learning framework as a reflection tool

Formal learning experiences are often based on deterministic outcomes and control the direction of learning. The learning framework can be used as a tool to reflect on how to incorporate more experiential, creative and empowering elements into learning. This might seem challenging and even feel inappropriate in some learning settings, however, to not challenge the stand-off between closed and open learning would be to miss essential elements, thinking and understanding about learning for sustainability.

A Possible Tool to Apply the Learning Framework

The proformas below presents one-way teachers and educators might wish to work with the learning framework either in planning or reflection. Blank rows are included to encourage new observations and contexts to be included so that it becomes personalised.

Is a biomimicry thinking process clearly present?		
Key elements	*Are they present? (yes, no, maybe)*	*Comments and reflections – where might you seek to improve or add in missing elements if relevant?*
Do activities connect learners with nature?		
Do activities encourage close observation of nature? (first-hand, images, video)		
Do activities reveal nature's talents and abilities? (function - strategy)		
Do activities provide connection between biological models and human design?		
Do activities provide opportunities to research or learn about natural examples?		
Do learning activities provide opportunities to create human designs based on nature?		
Do activities provide opportunity to reflect on and improve 'design' ideas?		
Do activities stimulate awe, wonder and respect for/about/in nature?		
Are biomimicry principles explored?		

Does content support STEM and sustainability learning?		
Key elements	*Are they present? (yes, no, maybe)*	*Comments and reflections – where might you seek to improve or add in missing elements if relevant?*
Does content encourage recognition that humans are a part of nature?		
Does content provide a relatable sustainability challenge?		
Is content strongly connected with a range of STE(A)M subjects?		
Can content be differentiated for pupil ability?		

Do teaching and learning approaches encourage engagement, exploration, explanation, elaboration and evaluation?		
Key elements	*Are they present? (yes, no, maybe)*	*Comments and reflections – where might you seek to improve or add in missing elements if relevant?*
Engagement: ○ Is it hands-on? ○ Is the outdoors/natural world used for learning? ○ Is it inter-disciplinary? ○ Is it something pupils care about? ○ Are learners engaged in a topic of interest?		
Exploration: ○ Do learners elicit information and create ideas for themselves? ○ Are hands-on and minds-on learning used?		
Explain: ○ Can learners share their findings with others? ○ Can learners demonstrate understanding? ○ Can learners discover relationships between content?		
Elaboration: ○ Can learners put ideas into practice? ○ Can learners apply their learning?		
Evaluation: ○ Do learners reflect on their work? ○ Can they learn from 'mistakes'?		

Do learning outcomes address each element?		
Key elements	*Are they present? (yes, no, maybe)*	*Comments and reflections – where might you seek to improve or add in missing elements if relevant?*
Observation – the ability to observe the natural (including humans) world closely and identify how it works.		
Curiosity – the ability to ask questions about the natural work, and to describe and draw it accurately.		
Problem solving – the ability to compare, explain, categorise and analyse in order to understand an issue and find solutions.		
Questioning – the ability to decide, prioritise, justify.		
Creativity – the ability to imagine, plan, design and relate (to something new).		
Connecting – the ability to relate content matter to personal interest, and to wider sustainability of natural systems which include humans.		

References and further reading

Baumeister (2014) Biomimicry Resource Handbook: A seed bank of best practices. Biomimicry 3.8.

Bybee, Taylor, Gardner, Scotter, Powell, Westbrook & Landes (2006) The BSCS 5E Instructional Model: Original, Effectiveness and Applications. BSCS Science Learning.

Deacon & Winks (2015) The Hand Model Guidelines: A handbook for building the approach into your practice. Real World Learning Network.